THE MARINE REVIEW

VOL. 47 CLEVELAND AUGUST, 1917 NEW YORK No. 8

Has Germany Lost Her Big Gamble?

Her Submarine Campaign Was Final Stake in Her Efforts to Win the War—Recent Berlin News Reveal Her Own Doubts of Success

SUBMARINES have the ability to torpedo cabinets as well as merchant ships, as a number of European statesmen have reason to know. The Italian and French ministries have been forced to face adverse comment by the elected representatives, while most of the neutral countries have been roused spasmodically to a dangerous pitch over the activities of the submersibles. Mr. Asquith relinquished the reins of government over England owing, largely, to the feeling that adequate precautions were not being taken to protect that island from the ravages of the underwater craft. Even Lloyd George, in his comparatively short tenure of office as premier, has faced one crisis resulting from a few weeks' unusually successful depredations.

Now the pendulum is swinging back and Von Bethmann Hollweg is facing the freest criticism any German chancellor has ever met. As an official responsible to the kaiser alone, the chancellor probably cares little for these criticisms, except as they reflect the growth of a disturbing sentiment among the rank and file of the German people, that is, a keener appreciation of the fact that the submarine campaign has not accomplished all that its promoters, including Von Bethmann Hollweg, claimed for it.

What has the submarine campaign done?

Staking All on a Last Gamble

The German chancellor, with that infrequent candor that he occasionally displays, once stated frankly that the submarine was Germany's final chance to win the war. This belief was held so generally that all of Germany's official family was won over to this last gamble. Its sure and swift success discounted the inevitable entry of the United States into the war.

At the end of five months, we find the German reichstag, newspapers and populace, in an uproar over electoral reforms. Recalling our none too clear perspective on Germany's internal affairs, we still feel free to deduce that a close association can be found between the present awkward situation at Berlin and the dubious success of the submarine campaign.

The British admiralty figures since March 1, when the weekly statements began to appear, show the loss of slightly less than 20 vessels of more than 1600 tons, every seven days. These losses, while serious, are not fatal. As an offset, about one-half million tons of German ships have been released from the protection of neutral powers which the submarine campaign transformed into belligerents.

Spending a Billion for Ships

Garbled as American news offered to German readers undoubtedly is, some realization must be entertained in Germany of the extent of this country's plans—half a billion already appropriated for ships and another half billion asked for. Pitted against the great shipyards of the British Isles and the daily increasing number and capacity of the shipbuilding plants in this country, even a German may well question the success of the Von Tirpitz idea.

A study of our monthly export figures also is encouraging. The May exports of iron and steel alone were nearly 600,000 tons and showed a gain over April of this year and May of last. They were slightly less than in January, the last month of our undoubted neutrality and far heavier than in February, the first month of our undoubted belligerency.

Any effectual measures which this country has taken to combat and down the submarine menace were absolutely necessary. Any slackening in our repressive efforts now would be distinctly unwise. But any panicky feeling which the submarine campaign may have aroused in its early stages, has been supplanted by the conviction that Germany, as on several previous occasions, overestimated her capacity to destroy.

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Developing Philadelphia Harbor

A Survey of the Port Facilities of the Quaker City—
Many New Municipal and Private Piers Will Be Built

THE city of Philadelphia, one of the principal manufacturing centers for heavy machinery and iron and steel products, and the second seaport in the country in point of tonnage of export and import trade, is located on the Delaware river, approximately 88 nautical miles from the ocean. By railroad it is situated about midway between New York and Baltimore—approximately 90 miles to the southward of the former and about the same distance to the northward of the latter—and is about 135 miles distant from Washington. It is the largest city in the state of Pennsylvania and the state's only seaport.

The city lies immediately above the junction of the Schuylkill river with the Delaware river and its central part occupies a peninsula about two miles in width between the two, a position on two deep water streams affording almost unlimited opportunity for commercial and shipping development. In extreme dimensions it measures about 10 miles from east to west by 16 miles from north to south, and covers a territory of about 130 square miles, or approximately 84,000 acres.

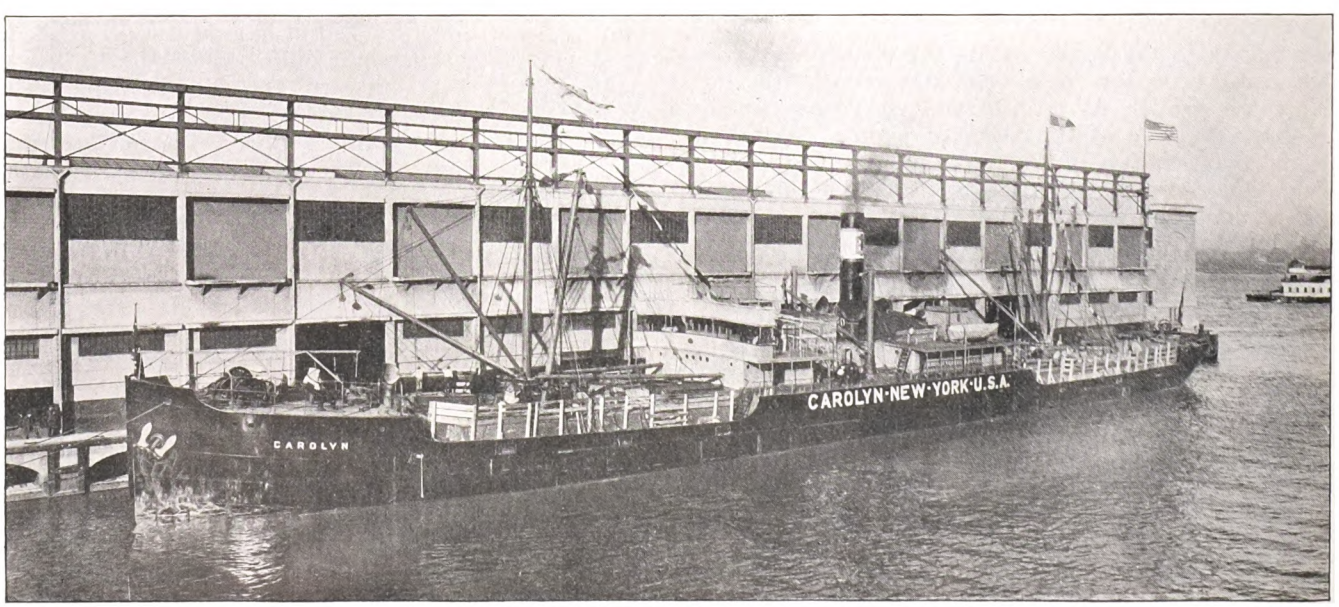
The water approach to the city is by way of the Delaware river and bay, the latter a commodious tidal estuary with natural, broad, deep water extending for 35 miles from the ocean to the entrance of the improved ship channel, from which point, a distance of 53 miles to Philadelphia, the channel is from 600 to 1,000 feet wide and 30 feet deep at low tide. This depth is constantly maintained by dredges of the United States government, and contract work is now under way for increasing the depth to 35 feet and the width to from 800 to 1,200 feet. This deeper and wider channel project, it is estimated, will be entirely completed in 1917, when the present satisfactory channel facilities will be greatly improved.

Water Terminals are Extensive

The river is excellently lighted from the sea to the mouth of the improved channel by powerful lights established in steel and concrete towers built along the edge of deep water in the bay, and from the entrance of the channel to the city, by gas buoys, and sets of shore range-lights located on the center lines of the various reaches of the channel, the whole forming a continuous guide to the mariner from one end of the channel to the other. More than 50 navigation lights are passed between the ocean capes and the city, an average of more than one to each two miles of channel. The buoying for day use is equally extensive, and it can safely be said that no water approach to any great seaport in the world, is safer or easier of navigation than that to the port of Philadelphia.

Philadelphia's facilities for handling marine commerce consist briefly of some 267 wharves of various sizes, for the accommodation of every character of vessel. There are 159 projecting piers. The waterfront terminals of three great trunk line railroads connect with tracks which extend over the entire American continent. Direct connection by regular lines of steamers sailing, in peace times, at fixed intervals, were had with London, Liverpool, Glasgow, Lieth, Hamburg, Bremen, Antwerp, Rotterdam, Copenhagen, Genoa, Naples, Triste, Calcutta, the West Indies, Central America and Panama, North Pacific and South American ports via the Isthmian canal, as well as nearly all the important domestic ports on the Atlantic and Pacific coasts and the Gulf of Mexico.

The administration of the port is under the jurisdiction of the department of wharves, docks and ferries, a branch of the city government, and the commissioners of navigation, a state department. The department of wharves, docks and ferries has charge of the construction and operation of municipal wharves and other harbor facilities, and general supervision of all waterfront activities of either a public or private nature. The commissioners of navigation are charged with the policing of the harbor, the anchoring and the reporting of vessels, etc. The functions of the two bodies are co-ordinate in character,



STEAMER CAROLYN—AN AMERICAN PIONEER IN THE SOUTH AMERICAN TRADE SAILING FROM MUNICIPAL PIER NO. 38, PHILADELPHIA

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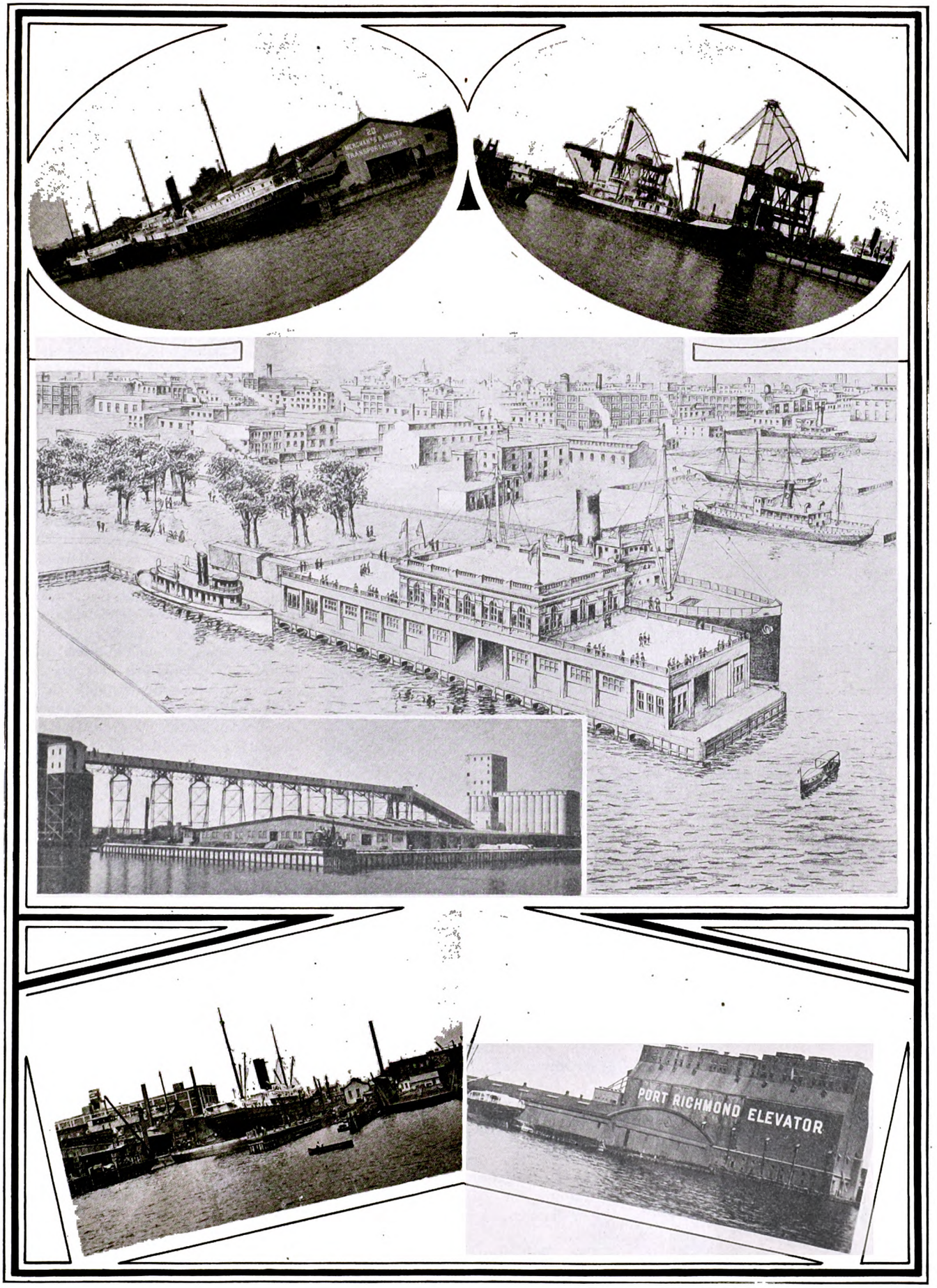

MODERN PORT DEVELOPMENT IN PHILADELPHIA

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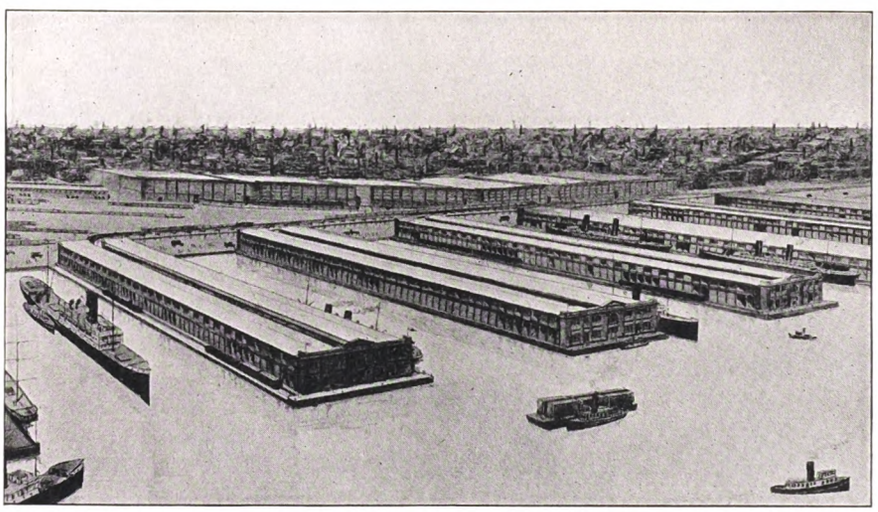
and many works of improvement are now under way under their respective supervision.

Philadelphia's total water frontage on the Delaware and Schuylkill rivers is about 37 miles, of which 20 miles are on the former and 17 on the latter stream. The most concentrated activities of the port are centered along about six miles of waterfront on the Delaware river, extending from Greenwich Point about three miles south of Market street, to Allegheny avenue, Port Richmond, about three miles north of that street. Portions of the Schuylkill river, however, also handle a considerable traffic, and owing to large exports of oil, nearly 45 per cent of the gross export tonnage of the port originates on this stream. Altogether, about half of the city front is improved and the present wharves afford a total berthing space of 162,500 lineal feet, of which about 35,000 lineal feet of wharf frontage is capable of accommodating ships of heavy draft. This provides berthing accommodation for nearly 100 fair-sized ocean steamers, and a large number of smaller vessels.



PROPOSED MOYAINENSING PIERS, PHILADELPHIA

Large Municipal Piers

The principal marine terminals of the port are those owned by the city, consisting at this time of seven large well-constructed piers, with one more in progress of erection (no mention being made in this connection of a score or more of small industrial wharves belonging to the municipality); the piers of the Pennsylvania railroad, 15 in all; those of the Philadelphia & Reading railroad, 23 in all; three piers belonging to the Baltimore & Ohio railroad; three piers of the Independent Pier Co., and the bulkhead wharves of the Atlantic Refining Co. and the Gulf Refining Co. on the Schuylkill river, having between them about 4,800 feet of berthing space for the accommodation of large ships.

The steamship piers belonging to the municipality are located mainly at the ends of streets in the central section of the city, and are designated ordinarily by the names of the highways upon which they abut. The piers at Arch, Race and Chestnut streets are used mainly for the accommodation of river and bay trade, and in a minor degree in the importation of tropical fruits. In addition to these uses, the piers at Race and Chestnut streets are provided with recreation pavilions on their upper decks for the convenience of the public. The pier at Vine street, a two-story steel and concrete structure, is leased by lines engaged in trade to Italian as well as other Mediterranean ports. The one-story pier at Dock street of the same type of construction is leased to Furness, Withy & Co., Ltd., the largest steamship company in the world. Pier No. 38, South Wharves, located between Catharine and Queen streets—a new modern pier of steel and concrete construction—is used for South American and European trade. Pier No. 40, South Wharves, adjoining, and of the same type of construction, is used for the exportation of flour to European countries.

The Independent Pier Co. operates four piers, located between South and Queen streets, South Delaware Wharves, two of the covered and two uncovered, the former with Belt Line railroad connection. Excellent accommodations for coastwise and ocean-going vessels are offered by this company.

The Baltimore & Ohio railroad operates at the present time only one general-cargo pier in Philadelphia, its main terminal having been destroyed by fire some time ago. This is a covered pier, located at the foot of Lombard street, South Delaware Wharves, and is provided with railroad tracks connecting to its own lines and to the Belt Line railroad. One export coal pier is also operated by this company, at the foot of Jackson street, South Wharves.

Railroad Terminals

The main Pennsylvania railroad steamship terminals, located between Queen and Christian streets, South Wharves, consist of five covered piers and one open pier for the use of regular passenger and freight steamers, both in the transatlantic and coastwise trade. An immigration station is maintained by the railroad at this terminal for the use of the lines berthing at this point. This company's coal terminals, consisting of six piers, are located at Greenwich Point, South Wharves. All of these are provided with car-dumping trestles for loading bunker and cargo coal, except one, upon which a mechanical car-dumping plant is installed. The loading capacity of this dumper is about 25 cars, or approximately 1,200 tons per hour. At Girard Point, on the north bank of the Schuylkill river near its junction with the Delaware, four large piers, two covered and two uncovered ones, are maintained by the company for handling ore, grain, cement and other heavy bulk cargoes. Upon one of these piers mechanical ore unloaders of 800 tons per hour capacity are installed, and two others are appurtenant to two large grain elevators with a storage capacity of 1,000,000 bushels each, and a total loading capacity of about 100,000 bushels per hour. All of these piers have direct rail connections both to the company's own lines and to those of the Belt Line railroad.

The Philadelphia & Reading railroad's general-cargo import piers are located between Callowhill and Noble streets, North Delaware Wharves, and its export piers, for the same class of cargo, between Cambria street and Allegheny avenue, North Wharves, this latter locality being known as Port Richmond. The import piers at Noble street consist of three covered wharves, one of these being a two-story pier with railroad tracks on both floors. The export piers at Port Richmond are six in number, four covered and two uncovered.

Besides the foregoing piers for ocean freight, the Merchants' & Miners' Transportation Co. and the Clyde Steamship Co. own and operate coastwise terminals, each with three piers. The remainder of the waterfront is developed in connection with various

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manufacturing enterprises and as these wharves are used for purposes in connection with the industrial establishments owning them and are not generally available for public use, no special mention of them will be made in this category, except in the case of those belonging to the large ship yards which have played so large a part in the development of both Philadelphia and the nation's commerce. Two of the largest ship yards on the American continent are located in the heart of the port, within one mile of each other, one of them, that of the William Cramp & Sons Ship & Engine Building Co., on the Philadelphia side of the river, and the other, the New York Ship Building Co., on the Camden or New Jersey side. These two important establishments each employ several thousand workmen.

Ranking next to these private yards, from a ship building point of view, is the Philadelphia navy yard of the United States government, situated on League Island in the extreme southern end of the city, just at the junction of the Schuylkill with the Delaware river. This establishment is located on a reservation containing more than 900 acres, and affords employment for some 2,000 to 3,000 men. It has approximately 4½ miles of deep water front capable of development for the accommodation of large ships, on which frontage there are already provided piers and bulkheads, at which may be berthed fully 60 vessels, or nearly half of the entire naval fleet. This is the only fresh water navy yard in the country and is now the navy's main repair yard and reserve station for vessels in ordinary.

Railroad Facilities Extensive

The excellence of Philadelphia's railroad facilities along her main waterfront can hardly be overstated, and place her in a position unique among Atlantic ports. Three great continental trunk line systems, the Pennsylvania railroad, the Philadelphia & Reading railroad, and the Baltimore & Ohio railroad maintain well-equipped marine terminals within a few miles of the heart of the city, at which ships of large size can dock and unload with safety and dispatch.

In addition, the main Delaware river waterfront is served by the Philadelphia Belt Line railroad, a quasi-public corporation, by means of whose facilities occupants of any of the public or private wharves in this section of the city can obtain direct car service. This is an exceedingly valuable privilege. The importance of this privilege to ship owners and operators and to large shippers, can scarcely be over-estimated. Practically all of the steamship wharves are provided with railroad tracks running on them for nearly their whole length, usually in sunken pits which bring the car floors level with the pier deck and greatly facilitate the easy and economical transfer of freight between vessels and cars and cars and vessels.

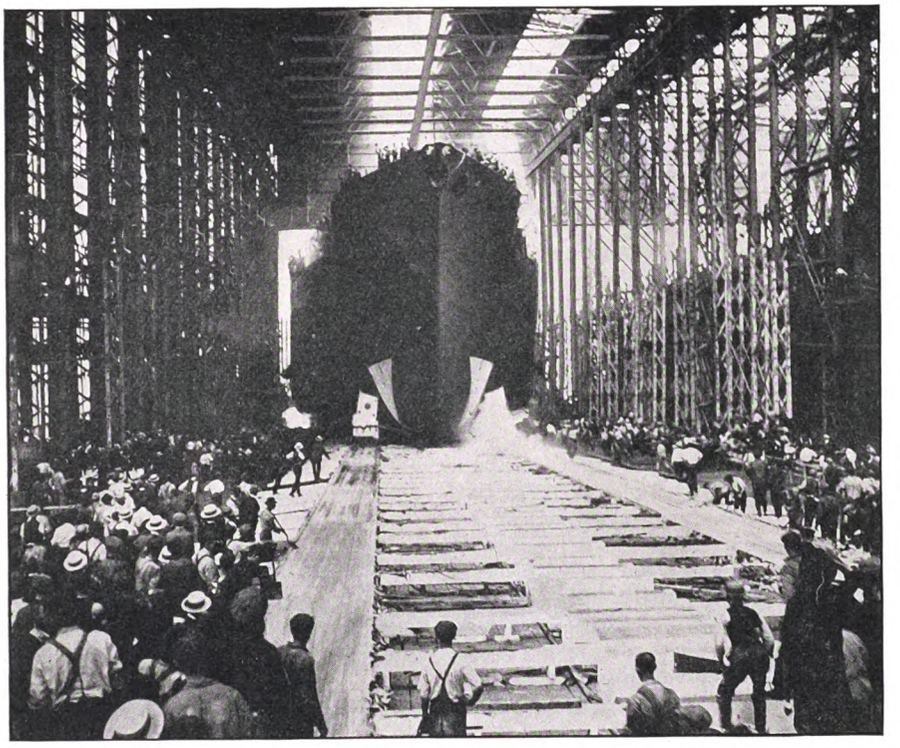
In addition to the harbor facilities described, extensive improvements are planned by both the municipality and the several railroad corporations having terminal wharves and yards on the Philadelphia waterfront. These contemplate the construction of a dozen or more modern, well-equipped, fireproof, two-story piers, of greater size than any now in the port, the establishment of new, large car storage and classification yards in the Greenwich section, near the southern end of the main Delaware river front, and the extension of belt line railroad tracks and connections along the waterfront. Funds are now available for and construction operations have been commenced. In all, $13,300,000 was appropriated during the past year alone.

A diver has made two trips to the bottom of the river at Milwaukee at the place where the CHRISTOPHER COLUMBUS was crushed by a falling tank, and a number of passengers killed. After a thorough exploration of the wreckage he reported that there were no bodies there. The Goodrich Transit Co. has petitioned Judge Geiger, in the United States court to limit liability for damages growing out of the accident.

New Sea Fighter Launched

The superdreadnought IDAHO, launched June 30 at the Camden, N. J., yards of the New York Shipbuilding Corp., is a sister ship of the battleships MISSISSIPPI and NEW MEXICO, now under construction. The MISSISSIPPI was launched Jan. 25 at the yards of the Newport News Shipbuilding & Dry Dock Co., Newport News, Va., while the NEW MEXICO was launched April 23 at the New York navy yard.

The IDAHO is 624 feet in length, 97 feet 4½ inches in extreme width, and has a mean draft of 30 feet. She will have a displacement of 32,000 tons. She carries Parsons turbines, geared for cruising, and capable of developing 32,000 horsepower, giving her a speed of 21 knots. She will mount twelve 14-inch guns in four turrets of three guns each.



LAUNCHING BATTLESHIP IDAHO AT CAMDEN

The new battleships ARIZONA and PENNSYLVANIA also carry 14-inch guns, but those on the IDAHO will be 50 calibers long, instead of 45 calibers, the length of those on the earlier 14-inch gun ships. The second battery carries 22 five-inch guns, and her armament is completed by two 21-inch torpedo tubes. She will be manned by 56 officers and 1141 men.

The IDAHO was authorized by congress on June 30, 1914. Her keel was laid Jan. 20, 1915. She was about 70 per cent completed when launched, and will be finished within her contract limit of 36 months. Miss Henrietta A. Simons, granddaughter of Gov. M. Alexander of Idaho, was the sponsor.

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The Science of Naval Architecture

A Study of Some of the Problems Encountered in Designing Ships —Wonderful Advance in This Science in Next 25 Years is Predicted

By David Watson Taylor

THE ART of shipbuilding was undoubtedly developed at a very early stage of the history of the human race. The earliest record of a ship, as distinct from a boat, canoe, or other small craft, is found in Egyptian carvings of a date about 3000 B. C. But the science of naval architecture, like so many other branches of science, developed slowly, this science, as now accepted, being mainly a development of the last hundred years, we may almost say of the last fifty years.

The famous Swedish naval architect and shipbuilder, Henry de Chapman, published a treatise on shipbuilding in 1775. As late as 1820 we find Dr. Inman, the head of the Royal Naval College and School of Naval Architects in Portsmouth Dockyard, England, publishing a translation of Chapman for the instruction of English students of naval architecture. Chapman's work, so far as it deals with the science of naval architecture, consists largely of empirical rules, although it was far in advance of his day, and much of it is still applicable to sailing ships. In some respects his ideas were largely erroneous, an example being his theories regarding resistance of ships. In fact, it was not until a hundred years after Chapman's time that the science of naval architecture was enriched by sound theories concerning this important branch.

Man's Greatest Work

Dealing with the sailing vessels concerning which Chapman wrote, Ruskin said:

Take it all in all, a ship of the line is the most honorable thing that man as a gregarious animal has ever produced. By himself, unaided, he can do better things than ships of the line; he can do poems and pictures and other combinations of what is best in him. But as a being living in flocks and hammering out with alternate strokes and mutual agreement what is necessary for him in those places, to get or produce the ship of the line is his first work. Into that he has put as much human patience, common sense, forethought, experimental philosophy, self-control, habits of order and obedience, thoroughly wrought handiwork, defiance of brute elements, careless courage, careful patriotism, and calm expectation of the judgment of God as can well be put into a space 300 feet long and 80 feet broad, and I am thankful to have lived in an age when I can see this thing done.

This is what Ruskin thought and wrote years ago of the ship of his day. His words are even more true of the ship of our present day and generation. His 300 feet of length has trebled, and the size of such a ship, as measured in terms of weight, has grown nearly 10 times. These modern ships have been made possible by the development of the science of naval architecture. This science, alone and unaided, without parallel development in practically all of the arts, sciences and trades, could not have produced these ships; but, so far as the ship itself is concerned, all the great progress in every branch of science and industry could not have produced this concentrated embodiment of human intelligence without the development and advancement of naval architecture or the theory of shipbuilding, a branch of applied science which calls upon and draws from an exceptional number of the arts and sciences.

Calls Upon Every Science

The modern battle cruiser, whose building is just being undertaken in this country, is an excellent example of the mutual agreement and co-ordination necessary between all the arts and sciences in the work of the naval architect. These vessels of ours will be of 35,000 tons displacement, and will be capable of a speed through the water of some 35 knots, or a little over 40 statute miles per hour. To drive this mass at this speed, there will be required a machinery installation capable of delivering 180,000 horsepower. The vessels are 850 feet in length; they will carry 10 high-powered 14-inch guns as a main battery, with the addition of a large number of guns of smaller caliber, to say nothing of the torpedo tubes.

Let us consider very shortly a few of the sciences involved when we undertake to build such a vessel. It is hardly necessary to say that this undertaking would not have been possible without the slow, steady development, through the ages, of the various theorems of pure mathematics, which, in their applied forms, have been necessary to material progress in the various branches of engineering. In addition to its general application, mathematics has made possible the modern systems of control of the firing of the great guns, which permit them, with a considerable degree of accuracy, to drop a shell weighing a ton, on a comparatively small target, at a distance of 12 to 15 miles. This accurate control of fire is based largely on instruments or mechanisms which permit the instantaneous solution of problems containing as many as half a dozen variables.

Likewise, these ships could not be possible without the aid of astronomy, for it is through the development of that science, and through the experimental results made possible by it, that the various navigational instruments can be utilized to permit a sure and safe passage of the ship from one point of the earth's surface to another.

How Chemistry Aids

Chemistry has played its part, not only in its general contributions to all engineering progress, but also in its solution of specific questions and difficulties, such as are involved in the manufacture of propellant powders and high explosives in forms that may be safely handled and carried on such a vessel until the selected moment for turning loose their destructive forces. Chemistry, also, through its particular manifestation in the form of metallurgy, has played one of the most important parts, by providing numerous varieties of steel, ferrous alloys, and nonferrous metals, with are used in the various parts of the ship and its equipment, many of these having been developed solely for the use to which they are put in such vessels as these.

Physics, in its various branches, has played a prominent role. In optics it has given us the theories of and has made practicable the various instruments which, in conjunction with fire control systems, make possible the accurate firing of guns and torpedoes, without which such a vessel would have no *raison d' etre.*

Acoustics has played its part in the solution of many particular problems and difficulties, for, in the same way that co-ordination has been carried out in constructing the ship, the most complete and harmonious co-ordination of all parts of its organization

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are necessary in her hour of trial by battle. This is rendered possible only by the most perfect means and instruments of communication throughout all parts of the vessel. These systems of communication must be such that they will not break down in the midst of the noises and confusion of battle, or because of the high mental tension, at such times, of the personnel using them.

The sciences of physiology, medicine, and hygiene must likewise play their parts, for, during the long years of peace, each of these vessels must be the healthful and, as far as possible, the happy home for anywhere from 1000 to 1500 men. This means that what we term in the navy "berthing and messing" facilities, or what in civil life would be referred to as the "housing and feeding" conditions, must be based on the most modern scientific principles. Likewise, to insure efficiency in battle, the design must take careful cognizance of what these sciences have taught us as to the limitations of human endurance when working at high pressure under adverse conditions. Nor do we stop at this point, for there is provided, in addition, a completely equipped medical establishment or hospital, including operating rooms, isolation wards for contagious diseases, special examining and treatment rooms, dental facilities, etc.

Branches of Naval Architecture

Without further enumeration of the many other branches of science and engineering which necessarily enter into the design of one of these great ships, let us consider more closely the principal branches of naval architecture proper. This is, broadly speaking, the division of engineering which enables us to make use of accumulated progress and knowledge to produce one workable and efficient assembled unit in the form of a ship. Its branches closely parallel the primary operations necessary in the design of such a ship, as has been described. Given the fundamental requirements of the design, which in the naval service we term military characteristics, and which consist of a brief statement of the results which it is desired to obtain with the completed vessel in service, it is first necessary to make an estimate of the size of the ship which will permit a solution of the design problem. The first estimate or approximation must be based largely on previous practice and experience. Before the development of naval architecture, in its modern sense, the necessity usually involved rather slow step-by-step progress from one ship to another. Naval architecture has now taught us how to make these steps much greater, so that during the last quarter of a century advances which would have been bold to rashness at an earlier time have become almost routine.

The rule of step-by-step progress referred to above has at least one remarkable—we may almost say astonishing—exception. Some 65 years ago a famous English civil engineer and bridge builder turned to shipbuilding. Maintaining that the larger the ship the more economical and efficient her operation, Brunel attracted large capital and in association with Scott Russell, the shipbuilder and naval architect, finally produced the GREAT EASTERN, which was indeed a giant by a pigmy when compared with the other iron steamships of her day. Her keel laid in 1854, launched in 1858 after many difficulties, and put in service in 1859, the GREAT EASTERN was not a commercial success. She fell short of the expectations of her designers in many respects. The successful completion even in five years of such a vessel was truly a remarkable accomplishment, but her size was ahead of her day, and it was not until 1899 that we find it again reached. As already stated, progress is more rapid nowadays than heretofore, but even now naval architecture would hardly enable us to take, with confidence, such a leap as the GREAT EASTERN promoters undertook.

He Designed Our Battle Fleet

Rear Admiral David Watson Taylor presented the accompanying paper before the Franklin institute a short time ago, just after he had received the Franklin medal. He was awarded the medal "in recognition of his fundamental contributions to the theory of ship resistance and screw propulsion, and of his signal success in the application of correct theory to the practical design of varied types of war vessels in the United States navy." Admiral Taylor is chief constructor and chief of the bureau of construction and repair of the United States navy.

Ship Strength and Stability

When in the early stages of a design we have, based on previous practice and experience, reached a first approximation to the size of the vessel, it is next necessary to examine in detail the problems of strength, stability, resistance and propulsion of ship. These represent broadly the main divisions of our subject. Naval architecture, as a whole, and its branches, like engineering generally, has not yet become an exact science, and in some respects it appears impossible that this will ever be attained. The strength and stability of ships, for example, should be such as to enable them to withstand, under all conditions, the waves of the sea, but the latter are infinite in variety, and the attempt must be to provide for any manifestation arising from this variety. It is, therefore, not possible in a new problem to lay down an exact condition of water surface, and say that if our ship can stand this condition it can stand all others. The best we can do is to make an approximation of the most severe condition, based on previous accumulated experience and observation. There have been made many thousands of observations on sea waves, but there is yet no complete agreement in regard to their limiting characteristics, such as length, height, and the relations existing between these dimensions.

Theory of Wave Formation

About the middle of the last century Rankine gave us the first complete mathematical theory of the formation and character of waves, known as the trochoidal theory; his result had, however, been largely predicted by Grestner more than 60 years before. Although Rankine's theory does not explain and is not entirely consistent with all phenomena of this nature, it is generally accepted today as a reasonable and convenient approximation of the facts, and it is usually upon stresses due to waves such as result from Rankine's theory that we have our determinations of strength of vessels.

We find that from the very beginning of practical shipbuilding the problem of strength was recognized in concrete form, for in the very first ship of which we have historical record its picture shows what we now term a "hogging" girder, which was provided to take the strains resulting from the variation between distribution of weight and distribution of buoyancy. It was the existence of these strains, and the fact that they increased with increase in length of ships, that operated to limit the length and consequently the size of ships during the era of wooden shipbuilding, as it was then, and still is impracticable to develop the full strength in end connections between contiguous wooden members. The introduction of iron and steel, in conjunction with the development of methods and mechanisms for riveting, has made the modern ship possible.

For many years the provision of the necessary strength depended largely on rule-of-thumb methods and step-by-step development from one

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ship to another. Such methods, of course, led, in the majority of cases, to one of two results: either deficiency of strength, or excess of strength. For any structure erected on shore, the latter fault is not necessarily a serious one, except from the point of view of cost. On a ship, however, too much material is almost as grave an error as too little, for every ship is built to perform some distinct service, and, as a floating body, can carry for all purposes only the equivalent of the weight of water which it displaces. Every pound which goes unnecessarily into the structure of the ship itself is a dead loss to the aim or object for which the vessel is designed.

Determining Longitudinal Strength

The modern theory of longitudinal strength for a vessel, as based on many years of observation and experiments, has its origin in the simple fundamental theories of strength of beams or girders. The ship's structure as a whole is considered as a built-up girder with upper and lower flanges and connecting webs. This girder is assumed to be supported on a wave of length equal to that of the ship. The height of this wave is assumed to have various relations to its length, depending upon the magnitude of that length, but for the majority of cases this relation is taken as 1 to 20. This girder is then assumed to be supported in a manner represented by the buoyancy curve of the ship when floating on such a wave. The form of this buoyancy curve will, of course, vary with the position of the ship in relation to the crest and hollow of the wave, and in important strength calculations it is redrawn for at least two, and sometimes as many as six, positions. The loading of the girder is represented by the loading of the ship, including its own weight, that of permanent installations, such as propelling machinery, etc., and that of the variable or useful load carried. By successive integrations and the use of the simple beam formula we then arrive at the figures representing stresses and strains in the theoretical girder. Some experiments have been made from time to time, notably those of Biles in 1903, to check the accuracy of the results obtained by this method, but, due to the cost and magnitude of such experiments, there have never been collected sufficient data to enable us to say how accurately these results do represent the actual stresses in the ship in service. Accordingly, we are still largely dependent on comparing the figures obtained by this method for the new ship with those obtained by the same method for previous ships that have shown adequate strength in service.

Possibly due to the fact that our standard wave is not so steep as waves having the length of short ships, and steeper than waves having the length of long ships, it seems to have been thoroughly established by experience that, with the method outlined above, it is safe to allow larger stresses in large and long ships than in short and small ones. If, for instance, we find that by this method a small vessel in service shows satisfactory results when her figured standard stress is, say, six tons in compression and eight tons in tension, and shows indication of weakness if these figures are materially exceeded, we would find that also in service a very large and long ship would show no signs of weakness with calculated stresses as high as 10 tons in compression and 12 tons in tension. This principle appears to have been acted upon, though the scientific principles underlying it were not fully understood, even in the early days of iron shipbuilding. This was brought out about 50 years ago, when our modern methods of figuring strength were first applied to ships built in accordance with the then existing rules of classification societies, with the result that the large ships of that day were found to have indicated stresses in extreme cases nearly five times as great as those found in small ships.

There are, of course, a very large number of strength problems involved logically in ships themselves, and therefore particularly within the province of naval architecture, but these are, after all, secondary when compared with the problem of the strength of the main structure.

The Question of Stability

Turning now to stability, which is the measure of the ability of a ship to remain upright or to return to the upright when inclined by an external force usually impressed by varying conditions of water surface, we find that the full and exact treatment of this branch is of quite modern origin. In the earliest day adequate stability was largely dependent on carrying ballast, and the amount and location of such ballast was determined by trial. In other words, except by following more or less closely the model of a previous vessel, there was no means of determining in advance whether a proposed design would result in a satisfactory stability condition.

About the middle of the eighteenth century the French mathematician, Bouguer, made a long step in developing the science of stability by developing the concept of the metacenter. In mathematical language, the metacenter is the center of curvature of the locus of the center of buoyancy of the vessel as it is inclined. As a practical proposition the metacenter is the limit above which we cannot locate the center of gravity of the ship without having her initially unstable and unable to remain upright. The position in space of this imaginary point depends upon the geometrical form and the dimensions of the ship. Perhaps a homely illustration may clarify the matter. If you take an ordinary rocking chair and attach a weight to it in such a manner that the center of gravity of the chair and the weight is above the center of curvature of the rocker, the chair will not stay put and will loll over and capsize. If the center of gravity is materially below the center of curvature of the rocker, which is the case when one sits in an ordinary rocking chair, the chair will remain in a fixed position; if the

Won Honors at School

"The career of Admiral Taylor must be a source of intense pride and an inspiration to every American; for his achievements are such as to place him in the foremost rank of naval engineers of any country and of any time.

"He was born March 4, 1864, *in Louisa county, Virginia, as a lineal descendant of distinguished soldiers and statesmen of the Revolutionary period. His early education and preparation for college he acquired by home instruction and study, entering the Randolph-Macon college in Virginia as a mere boy of* 13. *On completing the* 4-*year course in this institution in* 1884, *he won an appointment as cadet engineer in the naval academy at Annapolis, attaining second place among* 130 *competitors from the country-at-large. He graduated in* 1885 *at the head of his class, and with the highest percentage of marks for the entire course ever attained by any graduate of the academy before or since that date. In the fall of the same year he was ordered to London to enter a* 3-*year post-graduate course in naval architecture at the Royal Naval college at Greenwich. At the end of the first year he had made such a high record in scholarship that the secretary of the navy appointed him an assistant constructor with the rank of junior lieutenant, and upon the completion of the entire course he established a record for percentage of marks which has never been equaled by any graduate of the college, either before or since that time."*—From the presentation address.

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rocker is very flat, resulting in a greater distance of the center of gravity below the center of curvature, the chair will be stiff and harder to rock or heel from the upright position. The metacenter of a ship corresponds very closely with the center of curvature of the rocker, as already described.

After Bouguer developed the conception and mathematical methods for calculating the position of the metacenter, Atwood carried the matter further by calculating the righting arm or lever, which, multiplied by the weight involved, measures the torque when a vessel is inclined. The metacentric conception applies only to initial stability with the vessel upright, and for many years appears to have been sufficient, particularly as applied to sailing ships, which were very much of the same general type, with comparatively small variations of general form, relative freeboard, etc.

An Experiment That Capsized

Something more than 50 years ago, however, the loss of the CAPTAIN brought home very strongly to naval architects, particularly in England, the fact that there was another factor involved in stability. A distinguished English officer, Capt. Cowper Coles, took up with enthusiasm the monitor idea, first developed by Ericsson in this country, and as a result of his campaign there was built in England a low freeboard vessel called the CAPTAIN with turrets and also full sail power. Naval architects of the English admiralty were not enthusiastic over the type. The vessel had much less metacentric height than the pure monitor type, but early reports and experience with her indicated that she would be a great success, until on the night of Sept. 7, 1870, in the Bay of Biscay, with a moderate gale blowing, she capsized, with a loss of 481 lives, including Captain Coles himself. The vessel was perfectly safe until conditions were such that she heeled over enough to bring her deck edge well under water. After that her righting force rapidly decreased, and at a comparatively small heel became negative, resulting in capsizing. Under the weather conditions existing the force of the wind against the sails of the CAPTAIN was sufficient to heel her beyond the safety angle, and over she went.

The investigation into this disastrous occurrence brought out the fact that a vessel with a comparatively small metacentric height may be perfectly safe if it retains a righting tendency at a large angle of inclination—a feature associated primarily with high freeboard. On the other hand, a low freeboard vessel, with a comparatively short range of stability, may also be perfectly safe if its metacentric height and initial stability are very great, so far that a large amount of work has to be done to incline the vessel throughout its comparatively short range of stability.

Work at Model Basin

"Admiral Taylor's career of constructive work began as a member of the corps of naval constructors of our navy, in which position he greatly distinguished himself by solving a number of important problems in connection with the resistance and power of ships. The results of this work are recorded in numerous papers which he presented before the leading engineering societies of the world, and in two comprehensive treatises. His books on the 'Resistance of Ships and Screw Propulsion' and on 'The Speed and Power of Ships' have come to be universally recognized as the standard works upon these subjects.

"But his most important contributions to the scientific side of naval architecture are based upon the work he conducted at the United States experimental model basin, which he designed and constructed at Washington, in 1897, and of which he had charge until 1914. During this period of his life a surprisingly wide range of subjects engaged his attention, and many instances might be cited in illustration of his resourcefulness in formulating and experimentally attacking problems in subjects of which very little was known before. A case in point is his brilliant experimental researches on 'The Interaction Due to Suction Between Passing Vessels', a subject on which there was little or no reliable information, save a few observations on cases of damage to ships by unexplained collisions. By his brilliantly conceived and successfully conducted experiments he placed the subject on a scientific basis."—From the presentation address.

This whole question is now fairly well understood, and the naval architect is enable to adjust his metacentric height as he will by varying proportions and dimensions of the ship to suit the position of the center of gravity and type of vessel—all requiring very careful and detailed calculations. As a matter of fact, there are passenger vessels crossing the Atlantic in perfect safety with no initial stability, or even slightly negative metacentric height, their freeboard and shape giving them a range of stability of as much as 90 degrees.

Since the days of Fulton's first steamboat the design of vessels' hulls, on such lines as to give the minimum resistance in passage through the water at varying speeds, consistent with the other characteristics of the ship, has become increasingly important. This is well illustrated in the case of the new battle cruisers, to which I have already referred. To arrive at the most advantageous dimensions and form of hull, for purposes of the high speed desired, there were made and tested in the model tank at Washington upward of 20 models, with the result that the resistance of the model finally adopted was nearly 15 per cent less than that of the first model tried.

I would particularly invite attention to the fact, however, that this was by no means due to improvement in shape of lines alone, but also to other changes which were adopted with some reluctance, but which it was known in advance would materially reduce the resistance. Experience in recent years has fully confirmed the conclusion drawn from model basin investigations that, for high-speed vessels, the length is a primary factor. In fact, we know in the majority of cases of high speed vessels that we could reduce resistance by increasing the length. This usually involves, however, increased weight of hull and other objections. So that for large, fast vessels the naval architect usually adopts dimensions which do not give the minimum resistance for the displacement, but the best all-around result, considering the total weight, including both hull and machinery.

Why Battleships Are Short

Men-of-war in particular are generally made relatively shorter than merchant vessels, for the reason that ordinarily they travel at a low speed, and the long vessel requires more power at low speed than the short vessel, and hence on a given endurance requires a greater weight of fuel. The merchant vessel, particularly the fast passenger vessel making its passages at top speed or thereabouts, must be economical at that speed.

A hundred years ago the ideas of ship resistance were entirely crude, the usual opinion being that the resistance was in proportion to the area of the cross section of the vessel which had to be forced through the water. About the middle of the last century Rankine put forward a theory which went to the opposite extreme. His proposition was that in a well formed vessel the resistance was entirely due to the friction of the surface against the water, and he developed a method of estimating this. Our modern ideas on this sub-

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ject are due primarily to William Froude, the originator of modern experiments, which have been the most useful appliance of research in this line one could imagine. The *law of comparison* by which, from the resistance of a small model at low speed, we can closely estimate the resistance of a large ship at high speed, is commonly called by naval architects Froude's Law. It appears to have been originated independently by Mr. Froude, although as a matter of fact it is a particular case of the general law of mechanical similitude, apparently first enunciated by Newton.

How Ship Resistance is Found

The resistance of ships by the Froude methods is regarded as made up of three elements: The friction of the surface, which, for low-speed vessels, may be as much as 90 per cent of the total, and seldom falls below 50 per cent, even for very fast vessels; the wave-making resistance, due to the energy required to create and maintain a system of waves accompanying the motion of the ship through the water; and the eddy resistance, due mainly to eddies behind stern-posts, struts and other appendages, and hence quite a small factor in the total. The *law of comparison* applies with great accuracy to the wave-making resistance, and with reasonable accuracy to eddy resistance. To frictional resistance it is not applicable, but Mr. Froude, by experiments on surfaces, established coefficients of frictional resistance which are used to this day, although for some time naval architects have felt that it would be desirable to revise these coefficients upon the basis of experiments on a large scale. The procedure we use at the present time in obtaining the lines for a ship is about as follows:

By the use of tables and curves which have been produced as the result of years of experiment at the Washington model basin, certain coefficients, representing a form of under-water body, are selected, as giving a close approximation to the best solution of the particular problem in hand. By the use of these coefficients we can arrive at approximation to the best dimensions for any particular ship, and by the further use of certain standard forms of waterlines can draw, with little difficulty, the lines of the vessel. From the same data we can obtain a close approximation to the resistance, at varying speeds, of a hull built from these lines. These steps permit of settling the broad general characteristics of the design. The lines so drawn are then sent to the model basin, where a model to exact scale is built and its resistance accurately measured at varying speeds. In important designs, as in the case of the battle cruiser, this model will receive many variations in shape and refinements of details until it appears probable that the minimum resistance for such a hull has been reached. The resistance curve obtained from the final model is then used as the basis of the design of the machinery plant and propellers for the vessel.

There are, of course, many other divisions and subdivisions of naval architecture which enable us to foretell with a considerable degree of accuracy the behavior of a vessel under the many different conditions which may be met in a varied career of service, as, for instance, the degree of punishment which a ship can stand before sinking, when subjected to attack by gunfire, submarine torpedo, and mine and aerial bomb. These are factors which hitherto the naval architect has not been required to consider as regards merchant ships. If present piratical methods of war at sea are to continue, the distinction between merchant and war vessels will necessarily disappear.

As regards vessels of war, experience to date has shown broadly that the science of naval architecture has provided ships which function as anticipated. The enormously destructive weapons of the day are able to destroy in time anything that floats, and without disparaging Mahan's dictum that "Good men in poor ships have always won over poor men in good ships", there is no doubt that good ships are essential even to the best men. Our ships are now to undergo the "trial by ordeal" of the features carefully and patiently planned in past years. May they prove worthy of the good men that man them! There is one final thought, however, which naval architects the world over feel today. The progress of late years, which has seemed rapid, will seem slow indeed by the side of the progress and development which must and will be made during the years just ahead of us.

The science of naval architecture, whether applied to vessels of war or peace, has a weighty part to play as the world undertakes to meet the changed conditions of war time and of the time after the war.

Built Our Men-of-War

"During the years Admiral Taylor had charge of the model basin he by no means confined his attention to the theoretical aspects of naval architecture, but he was also the principal adviser to the chief constructor of the navy on all matters pertaining to the design of every vessel of importance on the navy list. It was in this capacity that he conceived what is now known as the American or center-line arrangement of gun turrets on the Dreadnought or big-gun type battleships built for the American navy, and which has since been adopted by every great naval power.

"In December, 1914, he was appointed, by the President, chief constructor of the United States navy, with the rank of rear admiral, and chief of the bureau of construction and repair. In this capacity he has been responsible for the design and building of the ships in the huge naval program provided for during the last two years.

"At this time, when our country's safety and success in the great war depends so largely upon a powerful and efficient navy, I deem it a special honor and privilege to present as Franklin medallist a man who has played a foremost part in its development, and who is conceded to be the greatest living naval architect and naval constructor, Admiral David Watson Taylor."—From the presentation address.

Use Lake Boats Along Coast in Winter

Various steamboat and shipping interests in Chicago are considering a plan to send some lake vessels to the coast for service during the winter months. The men who are fostering this scheme point out that these boats could be used to excellent advantage in the eastern coast shipping trade from November to April, when navigation on the Great Lakes is closed. Although the cost of refitting the boats for salt water service would, it is estimated, average about $5 per horsepower, the backers of the plan believe that with governmental co-operation, the plan will be entirely feasible. The originators of this idea believe that it will be possible to make arrangements with the government whereby the initial cost of replacing equipment will be borne by the government—the ship owners repaying the government from the profits earned during the five months when the boats are in service along the eastern coast.

Laden with lumber for China, the motor schooner MARGARET, on her maiden voyage from the Columbia river, sustained some damage from fire while off the Oregon coast. The vessel was towed back for repairs. The fire is reported to have been caused by a broken circuit in one of the engine room switchboards. The after part of the ship was gutted by the flames.

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In the Traffic Manager's Office

A Review of the Month on Coasts and Lakes—Useful Pointers for the Men Who Get the Business

War Profits Entrench Japan on Pacific

By Robert C. Hill

BEFORE the war" is a familiar phrase among Pacific coast ship brokers and charterers, for it covers the days when charter conditions were normal, in marked contrast to the situation today. Freights at present are so high that some of the larger shippers declare it will be impossible to operate longer. However, with each successive advance, the same statement has been heard and still cargoes have to move and shipowners, who are in a strategic position, continue to get their demands.

In view of the uncertainty prevailing today, much interest attaches to the recent announcement from Washington that joint action by the United States and allied governments will shortly be taken for the purpose of lowering ocean rates. This report, together with the commandeering by the United States of ships building in this country, has tended to increase the uncertainty in which the market finds itself. No one is willing to predict the outcome. In the same way, no one was willing to hazard a guess a year ago that freights today would be on the record high level now prevailing.

May Remove Japanese Tonnage

If concerted action is taken by the allied government, it will remove from the Pacific considerable Japanese tonnage which now is handling the greater part of the cargo movement across the western ocean. Previously, Japanese and Norwegian owners, who have vessels in the Pacific, have not been tempted by the relatively higher rates prevailing on Atlantic routes as they have been unwilling to assume the risks of sending their valuable tonnage through the war zone. Freights between this coast and the Orient have been sufficiently high to satisfy these owners.

A year ago, during the height of the rush of cargo to Vladivostok from Puget sound, when freights reached the high level of 45 shillings per deadweight ton, those in the market believed that the peak had been touched. Today, owners of tramp steamers are asking from 60 shillings to 62 shillings 6 pence per deadweight ton and charterers are offering from 55 shillings up. Months ago, the lumber rate from Puget sound to Great Britain, which normally was about 85 shillings, went up to 300 shillings. Shippers gasped and said the traffic could not stand it. Wheat freights from north Pacific ports to Great Britain soared and soared until they finally reached 150 shillings. Then, like lumber, they were lost to public view in the mysteries of "private terms" or in tonnage commandeered by the British admiralty.

In this connection it is interesting to recall that for years the normal rate for wheat from this coast to United Kingdom ports, by sailing ships around Cape Horn, was 27 shillings 6 pence. In "lean" years owners have received as low as 18 shillings per ton for wheat by this route, while the record low freight was received some years ago by French sailors which were chartered for 10 shillings per ton. Within the last 10 years lumber has been carried from Puget sound to Europe by sailing ship at as low a rate as 42 shillings 6 pence. However, it might be only fair to add that only high-grade spruce lumber, used in airplane construction, has for months been able to pay the abnormal freights now asked for cargo to Great Britain and all cargo moving on British steamers is under supervision and orders of the British government.

How Rates Have Advanced

Inasmuch as lumber is one of the principal exports from this coast, the fluctuations on this commodity form an interesting story when comparisons are offered. Table I furnishes these statistics for the past several years, the rates being those prevailing on July 1 of each year.

A study of these figures indicates the heights to which lumber rates have soared. It is also a noteworthy fact that charters to Chile and Peru are now figured in American money instead of shillings, as has been the custom. It is also true that coastwise freights have not kept pace with offshore rates, but this was due largely to apathy in the domestic trade. However, the coastwise business is now more active and so great is the demand for coasters than many old hulks, abandoned for years, have been rehabilitated and are now engaged in carrying lumber from Puget sound to Californian ports. The increase in freight rates to New Zealand, Australia and Hawaii is of prime importance to owners on this coast as those markets take the greater portion of the north Pacific's lumber surplus.

Just prior to the opening of hostilities three years ago, British tramp

Carriers Now Welcome Water Competition

Fairfax Harrison, of the American Railway association's special committee on national defense, has set forth the position of the railroads of the country regarding commercial transportation on the navigable waters of the United States, in a letter to Gen. William B. Black, chief of engineers, U. S. army. He states that the railroads are prepared for cordial co-operation. He says:

"In order that the position of the railroads regarding commercial transportation on the navigable waters of the United States may be clearly understood, at your request this committee now repeats in writing this statement: That the railroads will welcome any practicable water transportation and are prepared to co-operate cordially with responsible persons or corporations who may provide such water transportations, by the exchange of traffic, the assurance of joint through bills of lading, and, if necessary, where conditions justify it, by joining the water carriers in the building of tracks to connect the railroads with the wharves and landings of water carriers."

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steamers were chartered on this coast for lumber at 3 shillings 3 pence per deadweight ton, time. This is in marked contrast to the rate of $15 per deadweight ton, or approximately 60 shillings, at which figure the American steamer FRANCES L. SKINNER is reported to have been fixed this month for a voyage to the Orient. Late in 1915 and early in 1916, some far-sighted lumber exporters were thought to have gone mad when they chartered lumber vessels for Australia at rates from 100 shillings to 110 shillings for 1917 loading, but the wisdom of their foresight is now apparent.

Table I

Freight Rates on Lumber

From Puget Sound to:	1917	1916	1915	1914
San Francisco	$7.00	$6.00	$3.50	$3.50
Southern California	8.00	7.00	4.00	4.00
Hawaiian Islands	$18–19.00	17.00	9.50	6.00
New Zealand	125s	122s 6d	87s 6d	37s 6d–40s
Sydney, New South Wales	125s	122s 6d	87s 6d	37s 6d–40s
Melbourne-Adelaide	140s	135s	97s 6d–100s	42s 6d–45s
Chile-Peru	$40.00	125s	82s 6d	40s–45s
South Africa	260s	200s	130s	62s 6d–65s

Only One Slight Decline

Since early in 1915, following the chaos incident to the beginning of hostilities, freights have advanced with practically no setback. In the latter part of 1916, there was a slight decline in freights to the Orient, but within the past three months, not only was this loss overcome, but time charters forged to new high levels. For many months time charters for tramp steamers operating to the Orient ranged from 30 shillings to 35 shillings, but since April, the scarcity of tonnage and the heavy movement of freight has sent charters up to a 60-shilling level.

Illustrating the rise in ocean freights on this coast, it is but necessary to state that $8 was a fair normal price for carrying lumber from Puget sound to the Orient. Not long since a tramp steamer was fixed for this trade, the exporter paying $25 per thousand freight. Hemp, which formerly moved from Manila to Seattle on a basis of about 35 shillings per measurement ton, is now seeking space at $11.50 per bale, there being about three and one-third bales to each measurement ton. Rates on general cargo from the Orient, nitrates from the West coast and other commodities which must be moved have advanced in like proportion.

Profits to Japan and Norway

The Japanese and Norwegian shipowners are reaping the greater part of this great harvest. They were among the first to foresee the boom and to take advantage of the opportunity. For some time prior to the war, the Japanese had been purchasing second-hand British tonnage, and since the war the Japanese have been building ships as rapidly as possible, handicapped, as they are, by the necessity of importing steel. Some exceedingly fast work has been done in Nippon yards, there being record of their having turned out tramp steamers of good size in four months. All the yards in Japan are crowded with work and the building activity is certain to continue for several years.

Having lost many vessels in the danger zone, the Norwegians were early on the scene in placing orders for new tonnage at Pacific coast yards. They began at an opportune time, about 18 months ago, when Pacific yards were glad to get the contracts and when the cost of construction was closer to normal. One Norwegian owner ordered eight standard-size freighters from a Seattle builder at prices which, at that time, caused those who thought they were wise to express the belief that the daring Norse needed a guardian. Inasmuch as the value of these ships has increased at least $1,000,000 each within the past 12 months, further comment as to the astuteness of the Norwegian capitalist is unnecessary. Several ship contracts, awarded on this coast, changed hands at handsome profits long before the vessels were in frame.

Avoid Atlantic Trade

The fixed policy of Norwegian owners of vessels built on the Pacific is not to charter them for Atlantic trades notwithstanding the more attractive rates offered. In the Pacific, these vessels are finding very remunerative employment without the danger of submarines. The Norwegians expect, and without question their expectations are firmly justified, to make large profits in the next five years. The Japanese are similarly wise, as in a majority of instances, they will not consider charters which will send their vessels into the danger lanes.

Pacific coast yards have already turned out a considerable number of ships, both steel and wood, steam and motor. Some time ago, it was feared that the influx of this new tonnage would reduce freights on the Pacific. The very opposite, however, has been the case. The losses of tonnage in the Atlantic have boosted the freight market in the Pacific until today the scarcity of carriers is more pronounced than at any time in the past and fabulous prices are being paid both for charters and for vessels.

At the present time, new steel tonnage, of standard types, is being offered on a basis of $300 net per deadweight ton, while for auxiliary-powered ships some owners are willing to sell for $125 or $130 per deadweight ton. This means that one might purchase an 8800-ton steel steamer for the mere trifle of about $2,640,000, while a 2500-ton motor ship might be obtained for something like $325,000. These sales, of course, are subject to the consent of the government and in the present state of delightful uncertainty, it is next to impossible to sell or buy. New Japanese steel vessels are reported to be on the market at from $300 to $310 per ton, with prices advancing almost over night.

Japan's Position Stronger

Developments of the past two years have served to give the Japanese a stronger hold than ever on Pacific trade. Prior to the war, Japan was in financial stress. Today the island kingdom is enjoying unprecedented prosperity. It has approximately 2,000,000 tons of ocean-going tonnage and today about 80 per cent of Japanese commerce is being carried in Japanese vessels. Before the present era of shipping prosperity barely 40 per cent of the ocean business of Nippon was handled by vessels flying the Japanese flag.

Thanks to unfriendly laws and the reluctance of capital to invest under such conditions, the merchant marine of the United States has not profited

Table II

Japanese Shipping Gains During the War

	—1914—		—1917—	
	Tonnage	Per cent	Tonnage	Per cent
Japanese vessels	95,524	56	230,334	74
American vessels	55,289	33	23,211	8
British vessels	15,360	9	6,522	2
Norwegian vessels	2,788	2	19,455	6
Dutch vessels	.....	..	20,660	7

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in the same ratio as that of Japan. The opportunity was present, but only a few daring captains of finance and industry decided to invest in ships. The government's attitude in previous years was the deterring factor. However, some tonnage has been added to the Stars and Stripes in the last three years, but that on the Pacific consists largely of wooden, auxiliary power schooners, built for lumber carrying. At present, the seized German vessels are being added to the carrying fleet of the Pacific. This tonnage is being rapidly absorbed and freights continue their upward flight.

In Table II is an eloquent story, telling how the Japanese have profited by the conditions of the past two years, with another tale of how the United States has failed to seize the opportunity. These figures show the tonnage of each nationality engaged in the Pacific trades from the North Pacific just before the war and at the present time.

Will Hold Upper Hand

The loss in American tonnage is due largely to the withdrawal of the Great Northern steamer MINNESOTA and the retirement of the old Pacific Mail company. The British have withdrawn their vessels, as they have been required elsewhere. The increase in Norwegian tonnage is due solely to new vessels built on the Pacific for the hardy Norsemen. The table shows how the Japanese saw the opportunity and seized it. Before conditions become normal in the distant future, high freight rates and profits in ships are likely to make rich nations of the Norwegians and Japanese, because for several years they will hold the strategic hand in the great international game of shipping.

In the meantime, until the government announces its fixed policy and the allied nations determine whether or not they are to commandeer the fleets of all the countries aligned with Great Britain, chaos reigns supreme in the charter market and no one can predict the outcome. There is but one certainty and that is this: Those nations which prepared for themselves a merchant fleet will reap rich rewards for at least the next 10 years.

Freight Problems of Mississippi Valley

By Walter Parker
Special Assistant to Secretary Redfield

TRANSPORTATION economy throughout the drainage basin of the Mississippi river, which is served by more than 13,000 miles of navigable waterways, has passed through two distinct periods, and is now entering a third. First, in the order of their development, there was the raft, then the temporary barge, and finally the great steamboat with its extravagance and waste, and the steam towboat and towed barges.

In this period, floating craft enjoyed a complete monopoly. It had no competitor. There was no impelling incentive to do things in an economic way. It mattered little to the boatowner that the rain spoiled cargo at unimproved landings since the shipper paid the loss; or that the shipper complained of the service, since the shipper must continue using the boat, as there was no other way in which he was able to move his commerce.

Cities developed on the banks of the streams where most convenient to the boats, and these cities controlled all of the interior commerce. The movement of commerce was north and south, the natural channel of least resistance.

Influence of the Railroads

Next came the railroads. There being no concentrated commerce except that along the navigable streams which the boats had developed, the railroads began seeking means of taking over the business the boats had.

The railroads soon found that outlay for rails, equipment and overhead made the per ton mile cost of transportation by rail greater than by water. They also found that the cost of handling freight to and from boats, which had practically no terminal facilities, was excessive and that the cost of handling commodities to and from railroad cars could be greatly reduced through the building of convenient and ecomonic terminal facilities.

Railroads Take Boat Business

Then began the systematic development of the railroad terminal at the little towns and the big cities, and at the ports. Shippers soon found that such facilities were very convenient. The railroads found them not only profitable, but a great advantage in controlling freight movement. System in the solicitation of freight became a big factor in behalf of the railroads, and freedom to quote any rate that might be found necessary to take business from the boats developed into a far-reaching power. East and west railroad systems were built, and the handicap of mountain ranges was overcome by terminal efficiency, by systematic business methods, and by free play which they had in the making of rates.

Under such conditions, the boats were starved into the junk pile, the north and south trade route of least natural resistance lost its controlling factor, and a large volume of valley commerce moved over the new artificial east and west routes.

As the western half of the country developed under the influence of the railroads, valley trade centers began to grow in a remarkable way. St. Louis, by rail, is 1000 miles nearer the west than is any Atlantic coast trade center. The same is true of other valley trade centers. Consequently, the west traded with the developed valley cities, and the growth of the Pacific coast country helped them to a very important extent.

This system of transportation worked splendidly for most of the Mississippi valley, until a few years ago, when the influence of two new factors began to exert a strong and important effect.

Nonriver towns began to chafe under higher rates than the rates enjoyed by the river towns, and to ask for relief from the interstate commerce commission on the ground there were no boats on the rivers and that the river towns had no right to expect continued low rates at the expense of interior towns. The opening of the Panama canal opened the way for a water route between the east and west coasts of the country which, in normal times, make the all-water haul from the Atlantic seaboard to the Pacific coast cheaper than the all-rail haul from a valley city to the Pacific coast, which completely upsets valley transportation economy.

War Gives Opportunity

Then came the war. By imposing an increased burden on the American railroads the war has necessitated the use of additional means of transportation. By imposing a monster debt burden on practically the entire world, the war has forced the people of the United States, along with everybody else, to eliminate waste and to conduct their affairs in an economic manner.

And so it follows, that the third period in Mississippi valley transportation economy is now beginning. This cannot fail to result in two

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far-reaching improvements in a now unfavorable situation.

The efficiency of the railroads will be increased by a better character of local legislation and by a higher character of scientific management. The navigable streams of the valley will again be used to move commerce along natural north and south trade channels of least resistance.

In this third period, it is logical to expect the shippers of the Mississippi valley to do their own thinking on the subject of transportation economy. They had no opportunity to do so in the days when the boats enjoyed a monopoly, and no disposition to do so in the days when the railroads were offering greater convenience of service than the boats had been giving them. Today the railroads alone cannot protect the valley shippers, and the boats, through whose assistance absolute protection can be assured, are not yet in operation. But when a channel of relief is available, American business men can be depended on to correct an intolerable condition in short order.

Will Revive Boat Lines

It is therefore reasonable to expect that in the not distant future adequately financed and economically equipped boat lines, served by practical loading, unloading and housing facilities, and enjoying close connection and interchange with the railroads, will come into being first as an emergency measure and later as a permanent part of the valley's transportation equipment.

As a working start to attain this goal, the United States department of commerce has begun specialized endeavor to encourage shippers to use the waterways for the movement of commerce. A subcommittee of the national defense council, headed by Gen. W. M. Black, is engaged in solving the physical difficulties confronting the boat lines. The interstate commerce commission is prepared to enforce the law which provides for the physical connection between rail and water, and the issuance of joint bills of lading.

Trading Through the Ice-Bound Arctic

RUSSIA, under her new republican government, plans to promote vigorously her industrial development and the problem of developing her merchant marine is certain to receive early attention. A minor but interesting phase of Russia's shipping is the establishment of regular shipping lines to the Ob and Yenesei river districts. These rivers empty into the Kara sea, off northern Siberia and are ice locked most of the year. Until recently the immense districts which they drain had been completely out of touch with the outside world except through tedious land hauls to the trans-Siberian railroad. In recent years, various attempts have been made to develop lines to these river and recently these efforts have met with some degree of success.

Some of the difficulties of shipping to Siberia by this route were illustrated at the general meeting of the Siberian Steamship, Trading & Mfg. Co., held recently in Christiania, Norway, when the managing director made a report on the 1916 operations. At the beginning of the year the company's capital was increased from 500,000 kroner to 3,727,000 kroner. The two steamers EDAM (3,500 tons) and GRANLI (3,300 tons) were purchased, and it was the intention to use them for expeditions to the Ob and Yenesei, there being a good prospect of large shipments of butter. In the month of May, however, a new Russian law was passed prohibiting the export of that article, and the company's application for exceptional treatment was declined by the Russian government. At that time the company had bought one boat's cargo of hemp and rope, for which as a special favor an export permit was granted, so it was possible to send EDAM to the Yenesei, while the despatch of the second ship to the Ob was abandoned, and she was used in general trading on other trade routes.

Long negotiations for outward goods resulted in a full cargo from England, consisting of metals, machinery, and implements of various kinds, as well as some provisions, with a total value of 2,000,000 kroner. EDAM left Newcastle on Aug. 20, and four days later reached Trondhjem, where she took in about 400 tons, chiefly of machinery and appliances for the company's business on the Yenesei. After taking on board the ice pilot, EDAM left Tromso on Aug. 24, some 14 days later than usual. The delay was principally due to export formalities, but also to the difficulties that were met with in fixing the ice sheathing and the wireless apparatus, as all the works were full up with admiralty contracts.

Difficulties of Navigation

The weather was bad and there were occasionally heavy head seas, but in September Nova Zembla was sighted, and about the same time the first drift ice was met, although the ship was still some 150 miles from the Kara strait. The predictions as to a difficult ice year seemed to be holding good. The ice, however, was not in the worst condition, and the steamer was able to travel at half speed. From inquiries made by wireless it was ascertained that the strait and the southern portion of the Kara sea were free of ice. On Sept. 3, EDAM began to pass through the strait which was completely free, but in the evening, about 200 miles up the Kara sea, she ran into the worst drift ice that had ever been seen. The course was changed, and in fog, rain and gales the voyage was continued until EDAM was about 50 miles from Dickson island, off which the anchor was dropped on Sept. 8. From here the first message was sent through the new wireless station announcing the vessel's arrival, and by the next day the ship was already on her way to the loading port of Nosonofski, 300 kilometers up the river, which was reached on Sept. 11. Thus the voyage from Tromso was accomplished in 12½ days.

By Sept. 19 the 3,500-ton steamer had been discharged and loaded again. The work had proceeded night and day, with three gangs of altogether 80 men belonging to the river fleet. On Sept. 30, 11 days after leaving the Yenesei, anchor was dropped at Honningsvaag. The voyage had thus been completed in a month, including discharging and loading. On the homeward voyage through the Kara sea, ice was met of the same kind and at the same places as on the outward journey, and as it was so late in the season the whole of the homeward trip was accompanied by storms and fog. Altogether 600 miles of the voyage had to be made through ice.

"So far as the ice conditions are concerned," the managing director concluded, "it is generally admitted that there has not been such a bad season for nearly 40 years, and if it has been possible to carry out what in every respect was a record voyage, that must be regarded as a proof that one can make annual and regular use of the Kara route. The only regrettable thing about the year's expedition is the loss of EDAM. On Oct. 19, about six hours' voyage from Bergen, she was torpedoed by a German submarine while on her way to England, the crew being saved and take to Emden. That, however, does not in the least degree affect the possibilities of the navigation of the Kara sea. For the rest both ship and cargo were fully insured, and the company does not suffer any appreciable loss."

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Contracts for 176 Ships and Hulls Awarded by Shipping Board

Maj. Gen. George W. Goethals, general manager of the United States Shipping Board Emergency Fleet Corp., announced early in July that in the future nothing would be given out as to work on merchant ships. He announced this decision as a war measure, stating that the "government has found it necessary to adopt the policy of discouraging, in every reasonable way, the publication and dissemination of information in regard to merchant marine ship construction, that might aid or influence the military plans of the enemy."

The government's last statement, prior to General Goethals' announcement, was as follows:

The United States Shipping Board Emergency Fleet Corp. announces that to date it has executed the following contracts for the construction of merchant vessels in addition to the contracts previously announced. (See THE MARINE REVIEW, July, page 229.)

Seattle Construction & Dry Dock Co., Seattle: Ten steel cargo-carrying steamers complete; first and second steamers to be delivered in June, 1918; third in July, 1918; fourth and fifth in August, 1918; sixth in September, 1918; seventh and eighth in October, 1918; ninth in November, 1918; tenth in December, 1918.

The Foundation Co., Woolworth building, New York City. Works, Newark, N. J.: Ten wooden hulls; first hull to be delivered March 1, 1918; the remaining hulls to be delivered one every 15 days thereafter, so that the last hull will be delivered on or before Aug. 15, 1918.

Groton Iron Works, 50 Broad street, New York City. Works, Noank, Conn.: Twelve wooden hulls; first hull to be delivered five months after receipt of lumber for keels; remainder average of one hull every two weeks thereafter but all by Sept. 15, 1918.

Ship Construction & Trading Co., 50 Broadway, New York City. Works, Stonington, Conn.: Two wooden hulls; first hull to be delivered on or before Feb. 12, 1918; second on or before March 12, 1918.

Moore & Scott Iron Works, San Francisco. Works, Oakland, Cal.: Ten complete steel cargo carrying steamers. Deliveries: First and second in February, 1918; third in March, 1918; fourth and fifth in June, 1918; sixth in August, 1918; seventh and eighth in October, 1918; ninth and tenth in November, 1918.

Portland Ship Ceiling Co., 130 Commercial street, Portland, Me. Four wooden hulls. Deliveries: Feb. 1, 1918, March 15, 1918, May 1, 1918, June 15, 1918, respectively.

Universal Shipbuilding Co., 25 Broad street, New York City. Works, Houston Ship Canal, Harris county, Texas: Twelve wooden hulls. Deliveries: one and two seven months after completion of the ways; three and four eight months after completing ways; five and six nine months after completing ways; seven and eight 10 months after completing ways; nine and ten 11 months after completing ways; eleven and twelve 12 months after completing ways.

McBride & Law, Beaumont, Tex. Four wooden hulls: Deliveries: first hull on or before March 1, 1918; second hull on April 1, 1918; third hull on May 1, 1918; fourth hull on June 1, 1918.

Newcomb Life Boat Co., Hampton, Va. Four complete wooden cargo carrying steamers. Deliveries; First steamer by Jan. 15, 1918; remainder, one steamer every 60 days thereafter, so that last steamer will be delivered on or before July 16, 1918.

In addition to the foregoing contracts, the following contract for the construction of marine engines is announced:

Ellicott Machine Corp., Baltimore, 12 vertical triple expansion marine engines, size 22, 37½ and 60 x 42.

SUMMARY TO DATE

Total number of contracts for ships and hulls executed	22
Total number of ships and hulls contracted for	176
Complete steel ships	38
Complete composite ships	32
Complete wooden ships	34
Total complete ships	104
Total wooden hulls	72
Total number of contracts for marine engines executed	1
Total number of marine engines contracted for	12

(Signed) Geo. W. Goethals, General Manager.

June Ore Shipments

Ore shipments in June proved surprisingly large. The boats loaded 9,639,991 tons at upper lake docks, an increase of 132,415 tons over the corresponding month last year, which had held the record for the month of June. In view of the serious delays from ice and from other causes in the first half of June, last month's record greatly encouraged the men charged with the task of transporting sufficient supplies to keep the country's iron and steel industry in full operation. Up to July 1 this year, ore shipments total 16,135,135 tons, against 19,615,567 tons in the same period last year. The decline of 3,480,432 tons amounts to 17.74 per cent. This year's total is slightly in excess of 1913, the second best year, the lake fleet up to July 1, 1913, moving 16,125,042 tons.

The following table shows the June and season's shipments by ports:

Port	Shipments June	To July 1
Escanaba	909,804	2,205,297
Marquette	527,701	625,749
Ashland	1,176,517	1,909,468
Superior	2,121,663	3,562,082
Duluth	3,363,211	5,128,894
Two Harbors	1,541,095	2,739,645
Totals	9,639,991	16,135,135
1917 increase	132,415	.....
1917 decrease	.....	3,480,432

Lake Erie Receipts

Out of a total of 9,639,991 tons shipped from upper lake ports in June, Lake Erie ports received 7,577,763 tons, as shown by figures compiled by THE MARINE REVIEW. The balance on dock July 1 was 4,828,523 tons against 3,983,197 tons on July 1, 1916. Detailed receipts are:

Port	Gross tons
Buffalo and Port Colborne	997,383
Erie	231,814
Conneaut	1,519,860
Ashtabula	1,489,899
Fairport	378,938
Cleveland	1,574,642
Lorain	750,003
Huron	232,379
Toledo	326,984
Detroit	75,861
Total	7,577,763

Seattle Canal Opened

The Lake Washington canal connecting Puget sound with Lakes Union and Washington at Seattle, was formally opened by a public celebration held at Seattle July 4. The program included a military parade and a water pageant.

The Lake Washington canal, which has been thoroughly described in THE MARINE REVIEW is about 8 miles in length. It cost approximately $5,000,000. It adds more than 90 miles to Seattle's water front and gives access to extensive nontidal fresh water harbors. The channel of the canal is 100 feet wide and 36 feet deep. The locks are capable of lifting larger vessels than any government locks outside of the Panama canal. They are located at the Puget sound entrance to the canal and form the only barrier between the fresh water lakes, 9 feet above high tide, and the salt water. The major lock chamber is 825 feet long and 80 feet wide. The minor or smaller chamber is 150 feet long and 30 feet wide. Ocean-going craft go through the larger chamber in 20 minutes and small craft through the smaller chamber in 5 to 10 minutes.

Soo Canal Report

The total freight movement through the Soo canals up to July 1, shows a decline of 5,177,962 net tons from the tonnage moved in the corresponding period of 1916. Up to June 1, the decline was 5,442,656 net tons so that the fleet is slowly cutting down the big handicap imposed by unfavorable ice conditions in the early part of the season. The total movement so far this year aggregates 22,291,345 net tons against 27,469,307 net tons moved to July 1, 1916. June's movement aggregated 13,225,163 net tons against 12,960,469 net tons in June, 1916.

The detailed report of the Soo commerce up to July 1, 1917, and July 1, 1916, follows:

	To July 1, 1916	To July 1, 1917
EAST BOUND		
Flour, barrels	1,953,556	2,150,188
Wheat, bushels	84,123,491	67,574,955
Grain, bushels	29,714,152	32,192,482
Copper, net tons	30,807	35,809
Iron ore, net tons	18,474,348	14,954,818
Pig iron, net tons	14,215	.....
Lumber, M. ft. B. M.	85,898	75,188
Gen'l merchandse, net tons	55,499	51,716
Passengers, number	5,876	2,592
WEST BOUND		
Flour, barrels	205	80
Grain, bushels	1,010	.....
Coal, hard, net tons	616,558	661,948
Coal, soft, net tons	4,372,197	3,160,853
Iron ore, net tons	5,631	20,145
Mfctd. iron, net tons.	56,370	28,850
Salt, barrels	288,090	220,792
Gen'l merch., net tons	396,886	383,844
Passengers, number	4,753	2,590
SUMMARY		
Vessel passages, No.	7,597	5,980
Regis. tonnage, net	21,525,367	17,635,878
Freight:		
Eastbound, net tons	21,978,577	18,002,968
Westbound, net tons	5,490,730	4,288,377
Total frgt., net tons	27,469,307	22,291,345

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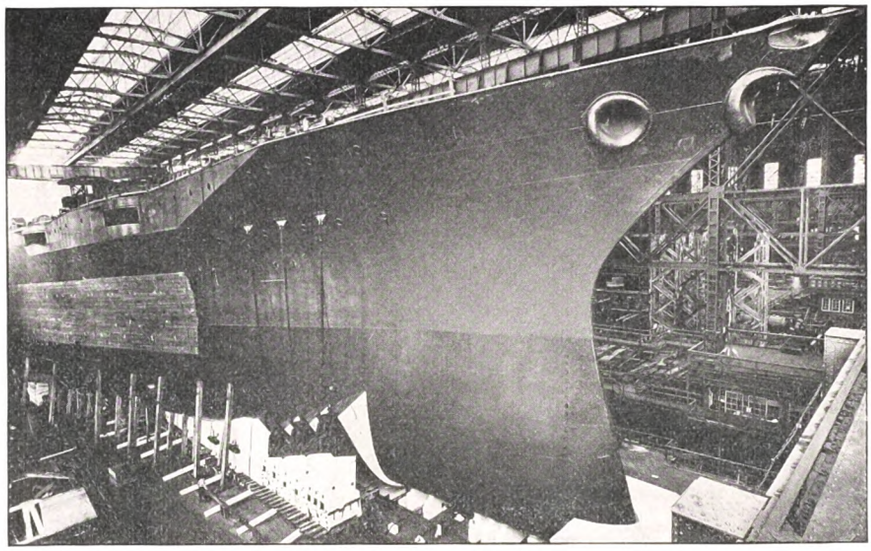
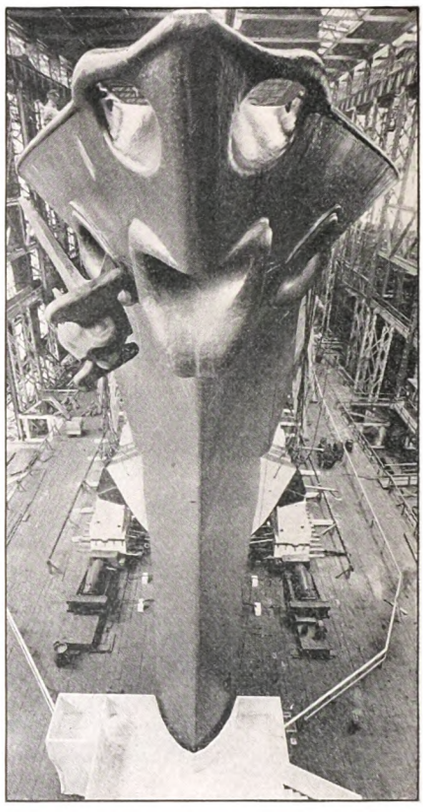
Latest Marine News in Pictures

Payment Will Be Made For Acceptable Photographs

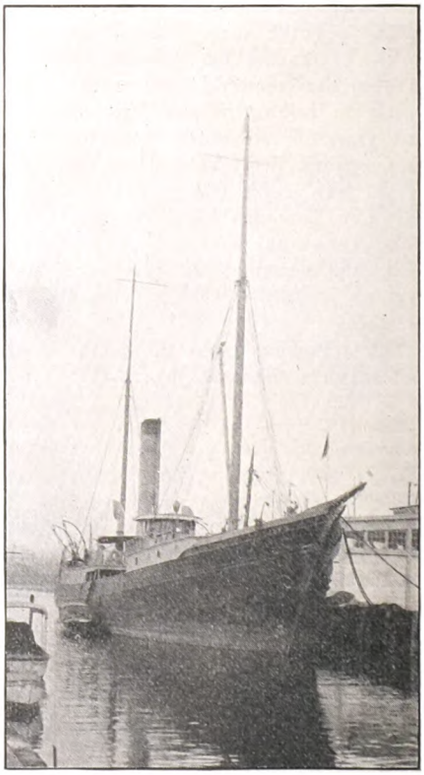


SUPERDREADNOUGHT IDAHO LOOKS LIKE A POWERFUL FIGHTER—IN A FEW MONTHS SHE MAY PROVE THAT HER APPEARANCE IS NOT DECEIVING



LIKE THE DRAGON HEADS OF VIKING DAYS, IDAHO'S BOW REVEALS HER WARLIKE CHARACTER

THIS CRAFT MAY RESEMBLE THE SUPERDREADNOUGHTS OF THE OLD INCAS—IT PLIES LAKE TITICACA JUST LIKE ITS PREDECESSORS DID HUNDREDS OF YEARS AGO



U. S. BOAT WHICH GUARDS WESTERN SALMON FISHERIES

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Photographs From Far and Near

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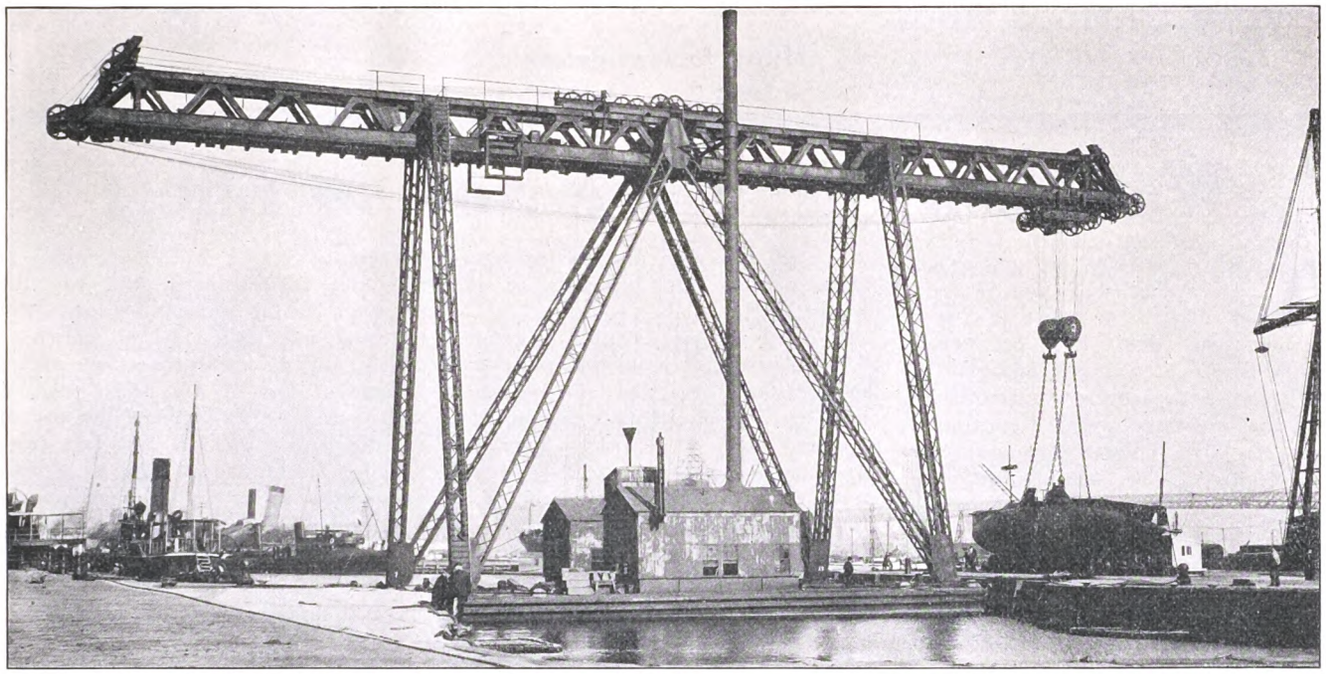
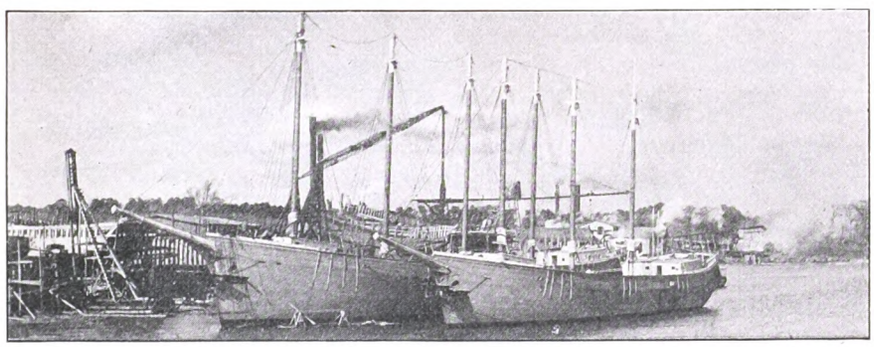


HUGE CRANE LIFTING A SUBMARINE—BUT NOT ONE OF THE FAMOUS U-TYPE



AUXILIARY SCHOONERS BUILT ON THE GULF, WHICH HAS SUDDENLY ASSUMED GREAT IMPORTANCE AS A SHIPBUILDING CENTER

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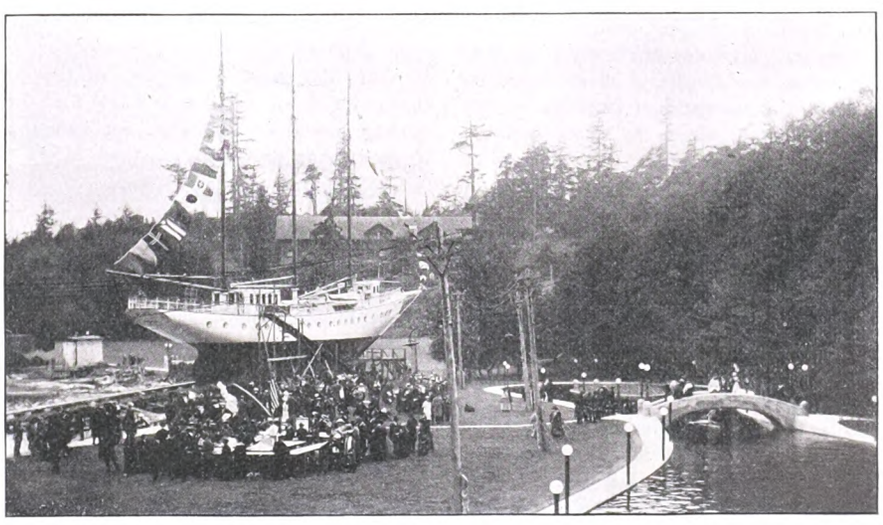
STUDENT OFFICERS LEARNING HOW TO USE A SEXTANT

FAMILIAR SIGHT ON AMERICAN CLYDE



SCHOONER RIGGED YACHT SANWAN BUILT COMPLETE BY ROBERT MORAN IN HIS WORKSHOPS ON ORCAS ISLAND, WASH.

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What the Government is Doing

Rulings on Marine Matters **Improvements to Waterways**

Hints to Navigators

War Risk Insurance Now in Effect

ARRANGEMENTS for the insurance against war risks of masters, officers and crews of American merchant vessels have been made by the bureau of war risk insurance of the treasury department in accordance with the provisions of the act approved June 12, 1917. Policies thus protecting the seamen of the American merchant marine have been issued by the bureau in connection with vessels sailing from the United States on and after June 26 and with vessels sailing from abroad to the United States, on and after July 10.

The new law permitting the granting of war risk insurance on the lives of officers and seamen of our merchant ships, just as the government grants war risk insurance on the hulls and cargoes of the vessels themselves, was enacted on the recommendation of the secretary of the treasury, approved by the President.

Must Protect Seamen

Seamen sailing on American vessels to the war zone are at the present time exposed to loss of life and personal injury, and it is manifestly necessary and just, Secretary McAdoo said, that these men, on whose service so much depends at this time, should be protected and assured by the government of proper and reasonable indemnity in the event of loss of life, or personal injury by war risks and compensation in the event of capture and detention by the enemy.

The law provides that when it shall appear to the secretary of the treasury desirable in the national interest, he may require vessel owners to effect such insurance at their expense. Exercising this authority, the secretary announced that it would be mandatory for owners of all steam vessels to insure against war risks, beginning with the dates mentioned above, the masters, officers and crews of all American steamships plying between the United States, the ports of Europe and the ports on the Mediterranean coast of Africa, and that such insurance will be permissive in regard to all other parts of the world.

Under the law, vessel owners may take out insurance with the bureau of war risk insurance or with insurance companies; but in connection with the latter such insurance must be on terms satisfactory to the secretary of the treasury.

To carry out the enlarged operations of the bureau of war risk insurance, the secretary organized the seamen's insurance division of that bureau, and appointed John J. Crowley, Hartford, Conn., as an assistant to Director De Lanoy. Mr. Crowley, who has charge of the details of the new division, is a life and accident insurance expert, and is well fitted for his new duties, having been with the Travelers Insurance Co., Hartford, Conn., for 14 years.

The plan evolved for carrying out the new work contemplates using virtually the same machinery which operates the insurance on hulls and cargoes—that is, the collectors of customs in all ports of the United States are agents of the bureau in this country in receiving applications for insurance and quoting rates, fixed by the bureau in Washington, with the approval of the secretary. In regard to the sailings from abroad to the United States, American consuls perform the same function. This permits the efficient and expeditious operation of the new division at a minimum of expense.

In case of death, permanent disability preventing the person injured from performing any and every kind of duty pertaining to his occupation, or the loss of both hands, both arms, both feet, both legs, or both eyes, the policies will provide for the payment of an amount equivalent to one year's earnings, or to 12 times the monthly earnings of the insured, as fixed in the articles for the voyage, but in no case shall such amount be more than $5000 or less than $1500.

Loss of Limb, Eye, or Hearing

In case of any of the following losses, the policies provide for the payment of the percentage indicated: One hand, 50 per cent; one arm, 65 per cent; one foot 50 per cent; one leg, 65 per cent; one eye, 45 per cent; total destruction of hearing, 50 per cent.

In case of detention by an enemy of the United States following capture, the policies provide for the payment during the continuance of such detention of compensation at the same rate as the earnings just preceding such detention. Owners of vessels will be required to take out the insurance and pay the premium, but the payment for losses will be made only to the master, officer or member of the crew concerned, except in case of loss of life, when payment will be made to the estate of the insured for distribution to his family free from liability of debt, and payment on account of detention by an enemy, following capture, will be made to dependents of the person detained, if these are designated by him.

Penalty for Failure to Insure

The law provides that in event of the failure of the owner of any vessel to effect insurance of the master, officers, and crew prior to sailing, the secretary of the treasury is authorized to effect such insurance with the bureau of war risk insurance at the expense of the owner of the vessel, and the latter will be liable for such expense, in addition to a penalty not exceeding $1000. The amount of the premium with interest, and of the penalty and all costs will be a lien on the vessel.

No claim agent or attorney, under the law, will be entitled to receive any compensation whatever for services in the collection of claims against the bureau of war risk insurance for death, personal injury, or detention, except in cases of proceedings before a United States district court in connection with disputed claims, when the judge will determine the amount of such compensation not to exceed 10 per cent of the amount recovered.

The following are the rates, subject to change without notice, which the secretary has approved for the insurance of masters, officers and crews:

	Rate per $100	
	Steamers	Sailing vessels or auxiliaries
Between ports on Atlantic Coast, U. S., and—		
Atlantic United States ports	$0.03	$0.06
Gulf United States ports	.05	.10
Halifax, St. John and St. Lawrence ports	.08	.16
Bermuda, Porto Rico, Cuba, San Domingo, United States Virgin Island	.06	.12
Other West India ports	.08	.16
Mexican Gulf ports	.06	.12
Panama	.08	.16
North coast South America (not south of Trinidad)	.11	.22

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South America between Trinidad and Cape St. Roque....	.19	.38
East coast South America below Cape St. Roque.....	.30	.60
Via canal:		
(a) Australasia	.23	.46
(b) India or Africa.....	.26	.52
(c) West Coast South America	.19	.38
Via Magellan:		
West coast South America..	.38	.76
Via Cape of Good Hope:		
(a) South and East Africa..	.45	.90
(b) Far East	.45	.90
West and south coast South Africa	.38	.76
United Kingdom	.75	....
France	.75	....
Italy, North Africa, Alexandria	.75	....
From U. S. Gulf ports, same as from U. S. Atlantic ports, except—		
Cuba	.04	.08
Other West India ports.....	.06	.12
Mexico	.04	.08
Panama	.06	.12
North Coast of South America (not south of Trinidad).....	.08	.16
South America between Trinidad and Cape St. Roque....	.11	.22
East coast South America below Cape St. Roque.....	.26	.52
Via canal—		
(a) Australasia	.19	.38
(b) India or Africa.....	.23	.46
(c) West coast South America	.15	.30
Between Pacific U. S. ports and—		
Pacific U. S. ports.....	.02	.04
Hawaiian Islands	.04	.08
Panama	.04	.08
Mexico and Central America..	.04	.08
West coast South America....	.08	.16
China, Japan, Philippines.....	.08	.16
Australasia	.08	.16
United Kingdom, via Panama..	.75	....
France, via Panama.....	.75	....
Italy, North Africa, Alexandria	.75	....

Qualifications Required of Student Officers

The United States shipping board's recruiting service recently issued a statement giving the minimum experience required of seafaring men who wish to enter any of the various grades for deck officers or engineers in the new merchant marine.

This information is based on the revised rules of the steamboat-inspection service, recently issued. These rules have been considerably modified to make admission to the merchant marine service easier for real sailors who hitherto may not have had opportunity to secure licenses as officers. The shipping board will take in hand any applicant with proper sea experience and give him the necessary free training in navigation to qualify him for his new position, at any one of its schools.

There are seven of these schools in New England: At Harvard university, Massachusetts Institute of Technology, New Bedford, Portland, Rockland, Machias and Boothbay Harbor. A second chain of the schools embraces Greenport, L. I., Atlantic City, Cape May, Crisfield, Md., Philadelphia, Baltimore and Norfolk. A third will embrace Charleston, Jacksonville, Mobile, New Orleans and Galveston, and a fourth Los Angeles, San Francisco and Portland, Oreg. Schools have also been established at points on the Great Lakes.

The engineering schools, which opened July 2, are at the Institute of Technology, Cambridge, where 150 men a month can be handled in a class; Stevens institute, Hoboken, N. J.; John Hopkins university, Baltimore; the Case School of Applied Science, Cleveland; the Armour institute, Chicago; Washington university, Seattle, and Tulane university, New Orleans.

Minimum Qualifications

The minimum qualifications, under the new rules, for entering the school for navigating officers, are as follows:

1. At least two years' experience in the deck department of ocean or coastwise steam vessels.
2. At least three years' experience in the deck department of ocean or coastwise sailing vessels.
3. At least three years' experience in the deck department of sailing vessels engaged in the ocean or coastwise fisheries.
4. At least one year's experience as mate of steam vessels engaged in the ocean or coastwise fisheries.
5. Two years' experience as master or chief mate of ocean or coastwise sailing vessels of 200 gross tons or over.
6. Two years' experience as master or pilot of lake, bay, or sound steam vessels.
7. A graduate from the seamanship class of a nautical-school ship.

Engineering School Qualifications

The minimum qualifications for entering the engineering schools are:

1. At least two years' experience as oiler or water tender, or combined experience of two years in these positions on ocean or coastwise steam vessels.
2. A graduate from the engineering class of a nautical-school ship.
3. A graduate in mechanical engineering from a duly recognized school of technology, with three months' sea experience.
4. A stationary engineer in full charge of a 1000-horsepower plant.
5. A locomotive engineer who has had six months' experience in the engine department of ocean or coastwise steam vessels.
6. A journeyman machinist who has been engaged in the construction or repairing of marine steam engines.
7. An apprentice to the machinists' trade who has been six months on a steam vessel.
8. Engineers of lake, bay, sound, or river steamers.
9. At least three years as fireman on an ocean or coastwise steam vessel.

Only American citizens are admitted to the schools. At the end of the school service the student is to be given sea training on pay. There is no enlistment, as in the navy, but if accepted for training an applicant is expected to sign on for the merchant marine, where wages at present are attractively high.

Applications for places in the merchant service are being received at the rate of several hundred daily by Henry Howard, director of recruiting for the United States shipping board, customhouse, Boston.

June Lake Levels

The United States Lake Survey reports the stages of the Great Lakes for the months of June, 1917, as follows:

	Ft. above mean sea level	
Lakes	May	June
Superior	602.38	602.60
Michigan-Huron	581.14	581.53
St. Clair	576.07	576.31
Erie	572.93	573.53
Ontario	246.51	246.98

Lake Superior is 0.22 foot higher than last month, 0.83 foot lower than a year ago, 0.34 foot above the average stage of June of the last ten years, 0.83 foot below the high stage of June, 1876, and 1.36 feet above the low stage of June, 1879. During the last ten years the June level has averaged 0.4 foot higher than the May level and 0.2 foot lower than the July level.

Lakes Michigan-Huron are 0.39 foot higher than last month, 0.55 foot higher than a year ago, 0.76 foot above the average stage of June of the last ten years, 2.07 feet below the high stage of June, 1886, and 1.63 feet above the low stage of June, 1896. During the last ten years the June level has averaged 0.3 foot higher than the May level and 0.1 foot lower than the July level.

Lake Erie is 0.60 foot higher than last month, 0.25 foot higher than a year ago, 0.61 foot above the average stage of June of the last ten years, 0.99 foot below the high stage of June, 1876, and 1.96 feet above the low stage of June, 1895. During the last ten years the June level has averaged 0.1 foot higher than the May level and 0.1 foot higher than the July level.

Lake Ontario is 0.47 foot higher than last month, 0.88 foot lower than a year ago, 0.06 foot below the average stage of June of the last ten years, 1.65 feet below the high stage of June, 1870, and 2.09 feet above the low stage of June, 1895. During the last ten years the June level has averaged 0.2 foot higher than the May level and 0.1 foot higher than the July level.

The Goderich Drydock & Shipbuilding Co., Ltd., Toronto, Ont., has been incorporated to build drydocks, boats, ships, vessels, machinery, etc., with $1,000,000 capital, by David I. Grant, Mervil MacDonald, 72 Alexander boulevard; Percy E. F. Smily, 16 Temple avenue, and others of Toronto.

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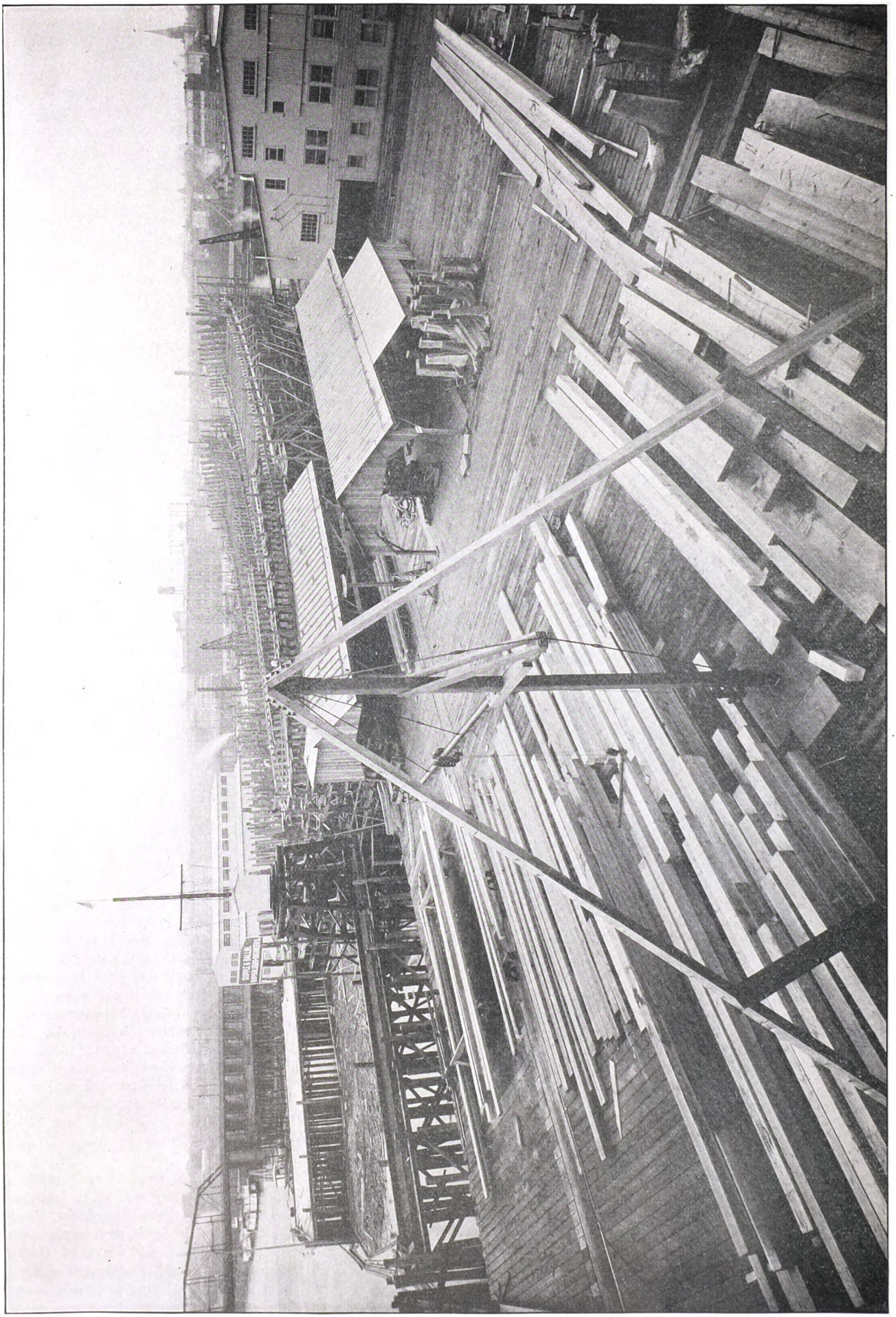

FIG. 15—A WELL LAID OUT WOODEN SHIPYARD LOCATED IN THE CENTER OF A LARGE CITY

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How Wooden Ships Are Built—III

This Installment Covers the Layout and Equipment of Modern Wooden Shipbuilding Plants—Thoughtful Planning is Necessary

By H. Cole Estep

IN THE two previous chapters in this series, the general possibilities and limitations of wooden ships were discussed and the structural characteristics of ship timber were studied in detail. Before the actual work of building the ship can commence, there is still another problem to be disposed of—the shipyard must be planned and equipped. If the prospective builder is going into the construction of wooden ships on a permanent basis, this problem is perhaps the most important one he will be called upon to solve. Mistakes in the design or method of building a given hull can be rectified when the next ship is laid down; blunders in the layout or equipment of the shipyard can seldom be corrected, except at prohibitive expense. Like most other old saws, the adage about the poor workman always blaming his tools is only a half truth; good workmanship demands the use of the best tools and is intolerant of slipshod equipment. Therefore, the shipbuilder who starts out with a half-baked, poorly laid out, pinched and skimped plant, is saddling himself with a handicap that may later spell ruin. The impression is all too prevalent that a well planned, thoroughly equipped plant, carefully arranged and organized, is relatively unnecessary for building wooden ships. Quite the reverse is true, and a study of the plants that have built ships continuously for a generation or more, through good times and bad, reveals the fact that they are all as completely equipped for their task as any steel shipyard. In fact, one of the unfortunate results of the present boom is the multiplication of hay-wire yards on both eastern and western coasts. If wooden shipbuilding is to establish itself permanently, the idea that anybody's back lot will do for a building site and a chest of carpenter's tools for equipment, must be definitely abandoned.

The Location of the Yard

The location of the yard is the first phase of the problem to be considered. Four factors govern the selection of the site: The supply of labor, the cost of the land, the contour of the ground and the depth of the water. Labor supply and real estate prices are complementary; where labor is abundant, property is expensive, and where land is cheap the supply of labor is dubious. The builder must compromise these conflicting elements to the best of his judgment and ability, remembering that a busy yard may carry a high overhead, but no plant can be run without men. It is significant that the most successful of the modern wooden shipbuilding plants on the Pacific coast are located in or near large cities. This would indicate that labor supply is the controlling factor.

In selecting a site for wooden shipbuilding, the slope and contour of the ground is important. Preferably, the ships should be built on dry land that has just sufficient natural slope to permit the laying of the keel blocks conveniently. There also must be level property for the construction of buildings and the storage of lumber. These conditions are not always easily fulfilled, although they are found in many of the oldest and most successful yards. In some cases, where long tide flats are encountered, filling has been resorted to, and although it is an expensive process, an ideal site can be created in this manner. An example

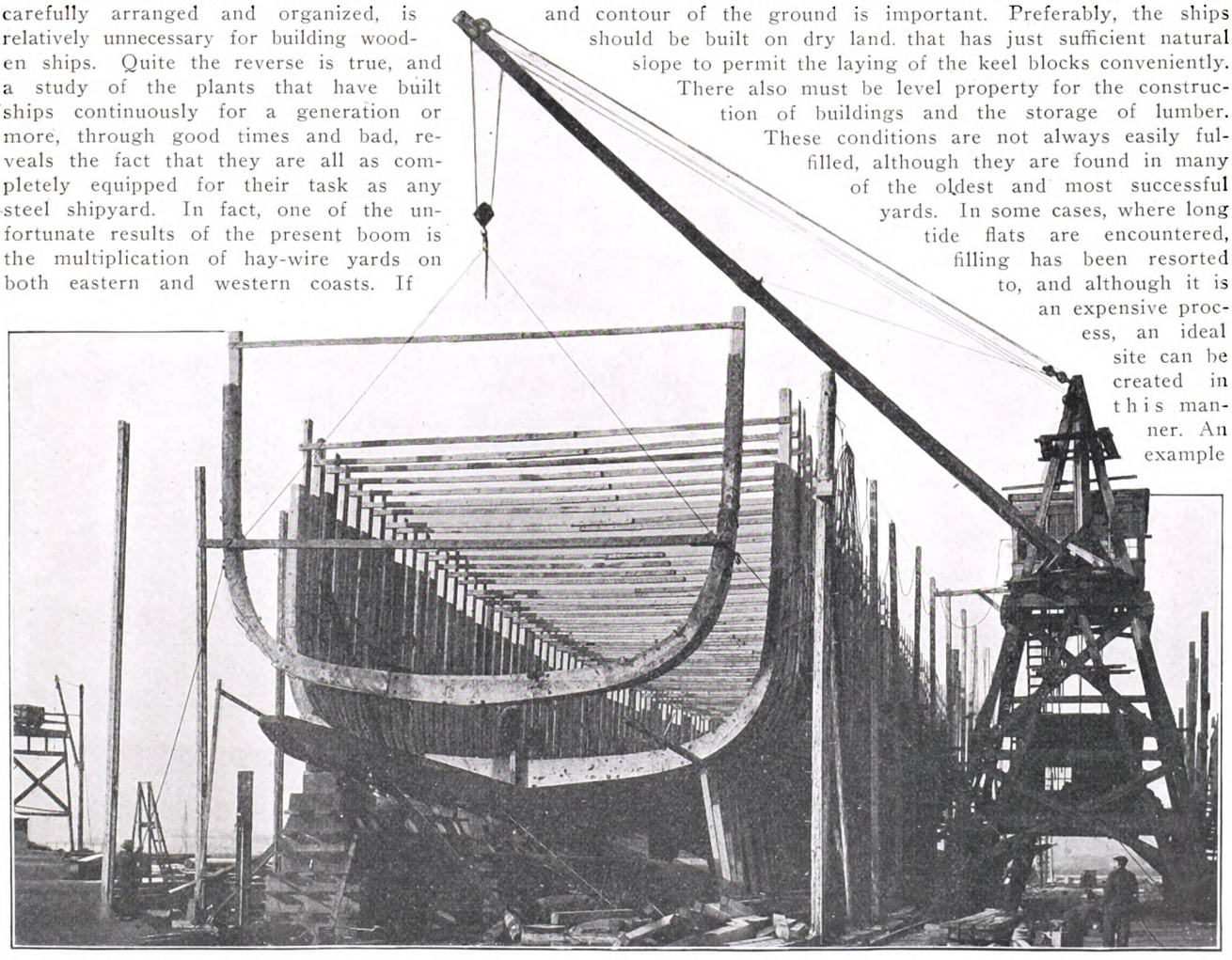

FIG. 16—ELECTRICALLY-DRIVEN, TRAVELING DERRICK SETTING FRAMES IN A WOODEN SHIPYARD

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FIG. 17—WOODEN SHIPYARD LOCATED ON NATURALLY SLOPING GROUND WITH AN ABUNDANCE OF ROOM

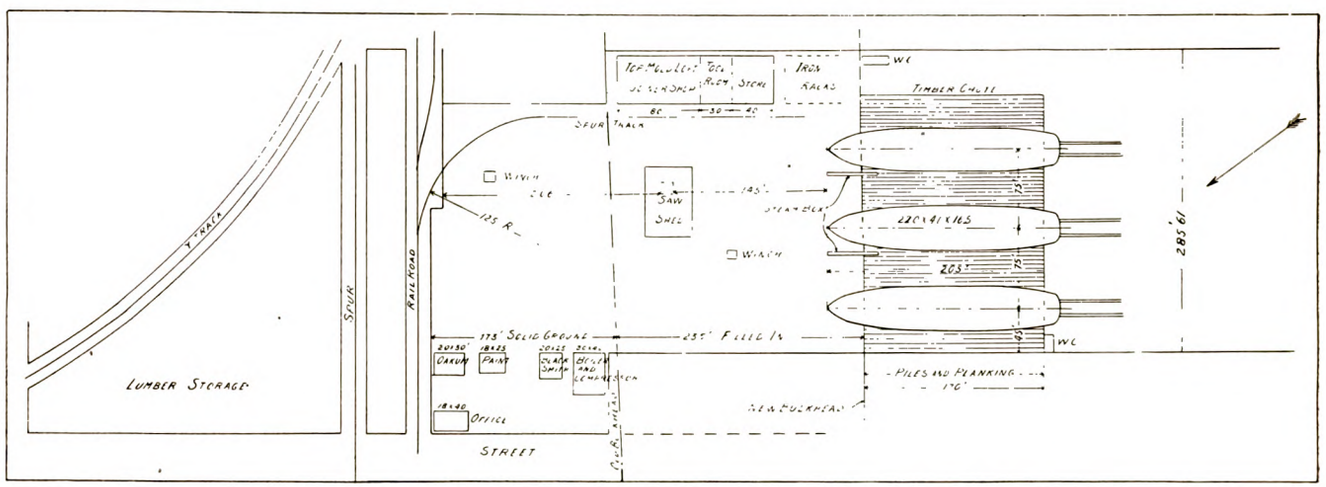

FIG. 18—A SMALL YARD LAID OUT ON LONG NARROW STRIP OF GROUND

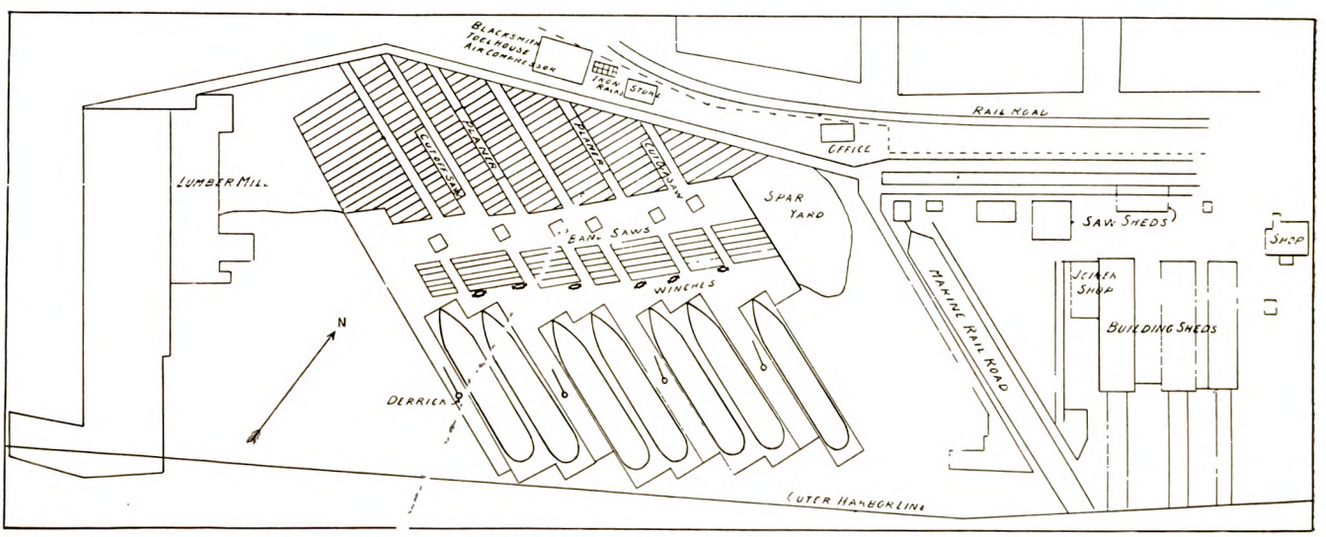

FIG. 19—YARD LAID OUT ON IRREGULAR PLOT OF GROUND

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of the relative importance of properly preparing the site is found in the estimates for a small California yard, in which the cost of buildings is given as $9280 and the yard work at $16,520, including $4720 for filling. In some Pacific coast yards where natural ground conditions are unfavorable, the building ways, framing stages and even the foundations for buildings and lumber storage have been placed on piles. On fresh-water rivers, safe from the ravages of the toredo, this procedure is not so objectionable as on salt water, but under all circumstances it is subject to criticism on account of being temporary and a source of continual expense for renewals. This practice can be defended only in cases where the builder feels his business is so purely transient that the expense of filling-in permanent foundations or paying enough for a suitable natural site, is unjustified.

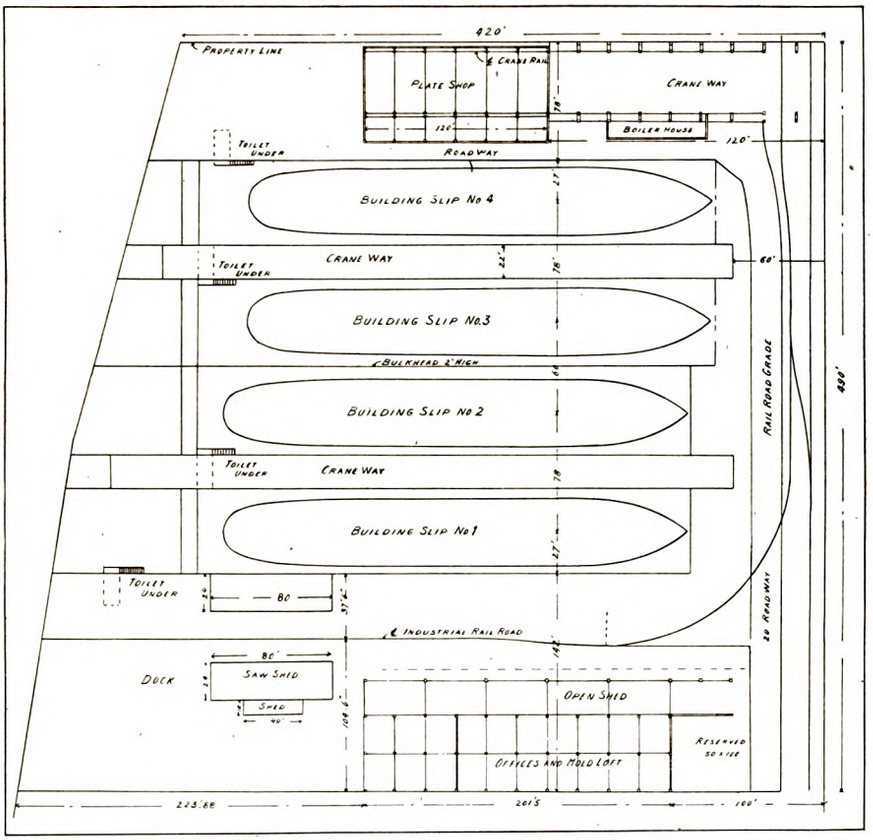

FIG. 20—YARD WITH FOUR BUILDING SLIPS COMPACTLY ARRANGED ON CITY PROPERTY

In many wooden shipyards too little consideration has been given the influence of the shape of the property on the progress of the material through the plant. Many yards, especially some of the newer ones, are laid out with no thought whatever, apparently, to the labor that might be saved by properly and thoughtfully routing the work. The principles of straight-line progress that are so ingrained in the metalworking industries and most other productive establishments, have been completely overlooked. The result is chaos and a tremendous waste of money. This comes from the practice of throwing the yards together rather than having them designed by a competent, experienced engineer.

If routing alone is to be considered, a long, narrow yard, in which

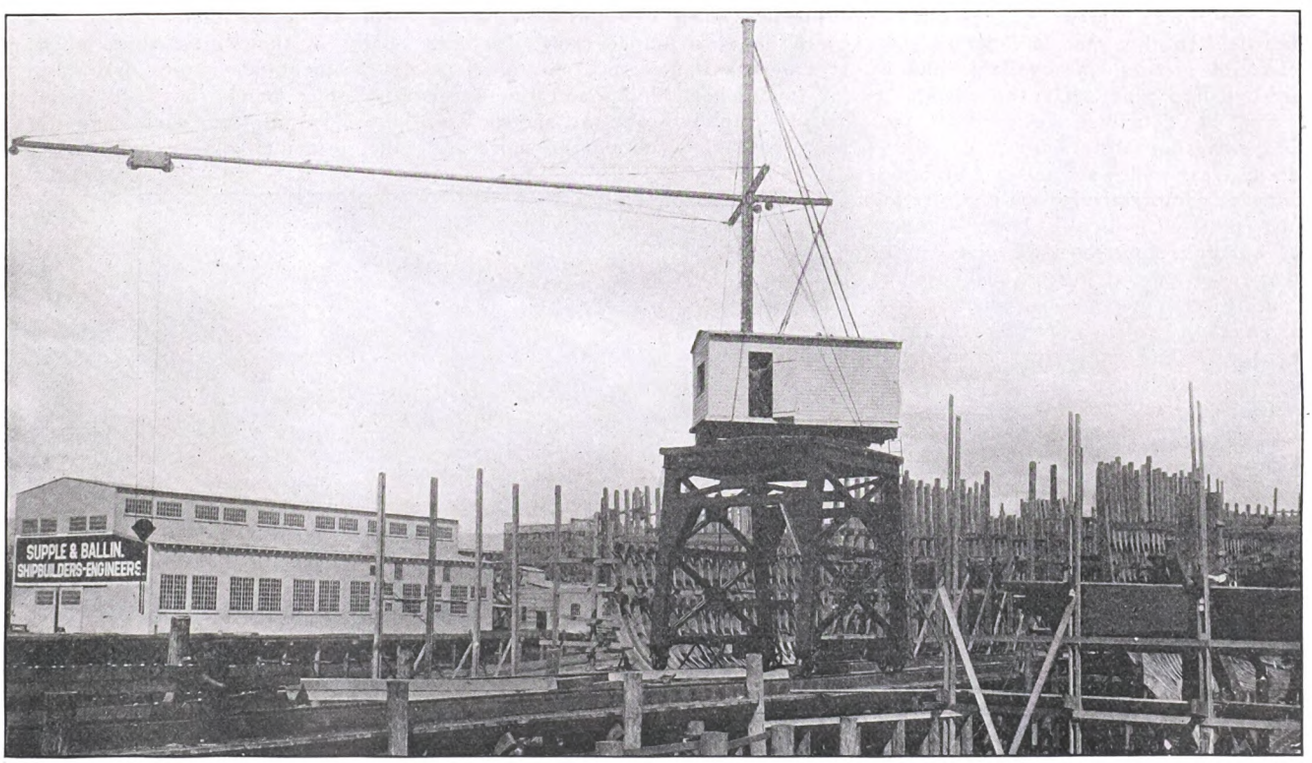

FIG. 21—A STEEL FRAMED REVOLVING CRANE FOR WOODEN SHIPYARD

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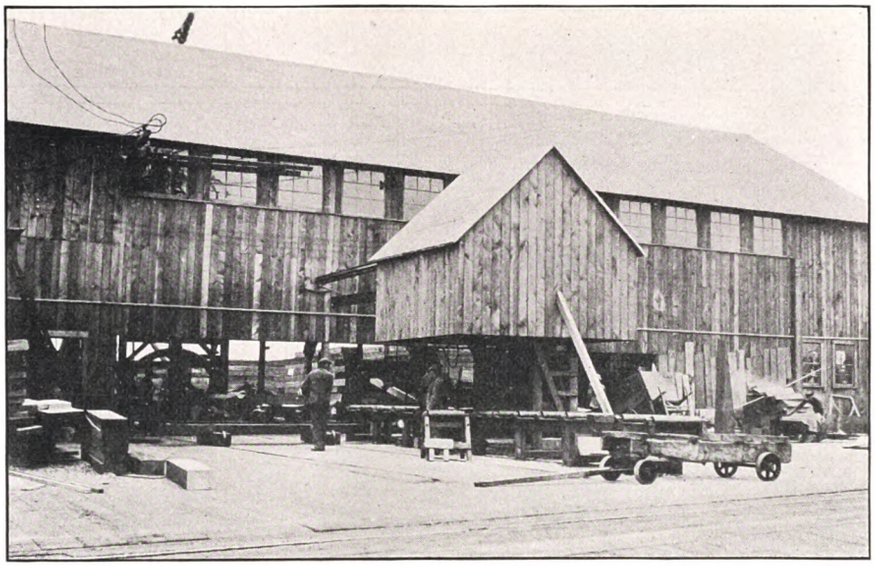

FIG. 22—MILL CONTAINING SAWS AND WOODWORKING MACHINERY

the raw material comes in at one end and proceeds in a straight line to the building ways at the other, is ideal. This arrangement can seldom be realized, and the next choice is a rectangular yard in which the material flows around only one corner and does not double back at any point. Regardless of the shape of the plot, however, and the limitations of property lines, a skilled designer can so arrange the equipment as to get the most out of the situation at hand and avoid waste in handling materials.

The accompanying illustrations, Figs. 18, 19 and 20, illustrate some of the principles of yard arrangement. Fig. 18 shows a small yard for three ships designed by Martin C. Erismann, Seattle. In this case, a long, narrow piece of ground was available and a straight-line plant was the result.

Fig. 19, detailing the yard of the Grays Harbor Motorship Corp., Aberdeen, Wash., shows what can be done with a comparatively shallow, irregular plot on which a large number of building slips must be placed. In this case, extra room and proper routing is obtained by placing the slips at an acute angle with the harbor line. The advantages of angular layouts of this general character have long been understood by industrial engineers.

Getting the Most Out of City Property

Fig. 20 shows what can be done on comparatively restricted ground area in the heart of a city. In this case, four building slips for ships of the largest size are provided, together with ample room for shops of a more elaborate character than are usually found around wooden shipbuilding plants, yet the plant is not overcrowded. The lumber moves across the yard from south to north and is properly distributed by means of the traveling cranes between the first and second and third and fourth slips. The steel fittings, which are made-up in the plate shop, move in the opposite direction. This plant is operated by Supple & Ballin, Portland, Oreg. How the arrangement works out in actual practice is shown clearly in Fig. 15, which gives a good general view of the yard under operating conditions.

The patent advantages of an almost perfect natural site, with unlimited room, are shown in Fig. 17, which illustrates the yard of the Winslow Marine Railway & Shipbuilding Co., Winslow, Wash. In this case, piling or filling are unnecessary, for the ground has the correct natural slope for laying keel blocks and the water deepens rapidly from the shore. The ways are laid out along the shore and covered by sheds, with the shops, mill, etc., immediately in the rear.

The cost of wooden shipyards varies, of course, within wide limits, depending on the locality, price of the ground, number of building slips and the completeness of the shop and yard equipment. In altogether too many cases the latter item is dangerously slighted. Probably $45,000 represents the minimum for three slips, and in this case the margin is hardly comfortable. From this figure, the investment ranges up to $500,000. While no definite suggestions can be given where so many variables are to be considered, it is safe to say that a reasonable sum invested in the plant and its equipment makes for permanent success.

Proper Design and Layout

This chapter is concerned with the general phases of yard design and layout. Details, such as the construction, slope and arrangement of the keel blocks and the foundations of the building slips will be treated later in the chapters devoted to construction procedure. Various methods of laying out the building slips are suggested by the drawings, Figs. 18, 19 and 20, previously mentioned.

In the north Pacific coast region, on Puget sound and the Columbia river, the question of protecting the building slips with sheds is a moot one. There is no doubt the protection of the work from the weather during construction tends to add to the life of the vessel, and that from the standpoint of the comfort of the workmen and their efficiency, especially in the winter time when rain is frequent, sheds are desirable. On the other hand, they add greatly to the cost of the yard, and this is the principal reason why so much

FIG. 23—CUT-OFF AND BAND SAW SHEDS IN A WESTERN SHIPYARD

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Table V

Cost of Buildings, etc., for Small Yard Shown in Fig. 18

Three Building Slips

Mold loft, 2-story, 45 x 100 feet, bottom floor containing joiner shop, 45 x 80; tool room, 45 x 30 and store room, 45 x 40	$4,500
Office, 18 x 35 feet	1,000
Blacksmith shop, 20 x 25 feet	350
Oakum store, 20 x 30 feet	400
Boiler house and compressor room, 30 x 40 feet	800
Steel storage racks	150
Paint shop, 18 x 25 feet	150
Saw sheds, 45 x 70 feet	250
Steam boxes, two 3 x 3 x 50 feet	180
Piping for water and air	1,500
Spur track	800
Filling and bulkheading	4,720
Ways, piling and flooring	10,000
Miscellaneous	1,000
Total	$25,800

Table VI

Equipment for Small Shipyard Shown in Fig. 18

One 48-inch band saw	$2,600
One 20-horsepower motor for band saw	421
Two 30-inch saws for loft and joiner shop	330
Two motors for 30-inch saws	200
One circular table saw	425
One buzz knee planer or 24-inch jointer	700
One bolt cutter	350
Grindstones and emery wheels	200
Mauls, dogs, chains, rope, peavys	2,000
Forty jacks	320
Clamps, screws, Nelson iron	1,000
Two anvils	150
Two forges	200
Two steam winches	3,000
One drill press	450
One air compressor	2,696
Six 90-lb. air hammers	300
One extra heavy hammer	175
Six wood boring machine	450
Air hose	300
Motors	1,000
Boiler, pumps, etc.	1,500
Miscellaneous	1,000
Total	$19,767

work is being done out-of-doors on both coasts. A well designed, light, permanent building-shed big enough to protect a hull up to 300 feet in length, is shown in Fig. 34. Such a shed costs over $20,000. This shed is provided with a monorail crane system for economically handling materials. Some modern wooden shipbuilders have not provided sheds because they preclude the use of cranes that are considered to be of an unusually efficient type.

This brings us to the consideration of the equipment necessary for economically handling materials, which, with the tools required for working-up timbers, constitutes the bulk of the machinery in a wooden shipyard. In many wooden shipyards, as previously suggested, the problem of handling lumber and other materials has been given scant consideration. Too often the traditions of the logging camp and the old-line sawmill have been handed on to the shipyard without any thought of the difference in the problems to be solved.

In the smaller yards, however, where the overhead soon becomes topheavy, simplicity of equipment is permissible. In such cases, a small hoisting engine or two and a few hundred feet of wire rope are about all that are required for handling timbers, supplemented by a few dollies or lumber trucks. The timbers are handled by skidding them from place to place in the conventional lumberman's fashion.

Fig. 28 shows the hoisting and skidding equipment for a Pacific coast shipyard with three building ways. In this case the outfit consists of one double-drum and one single-drum

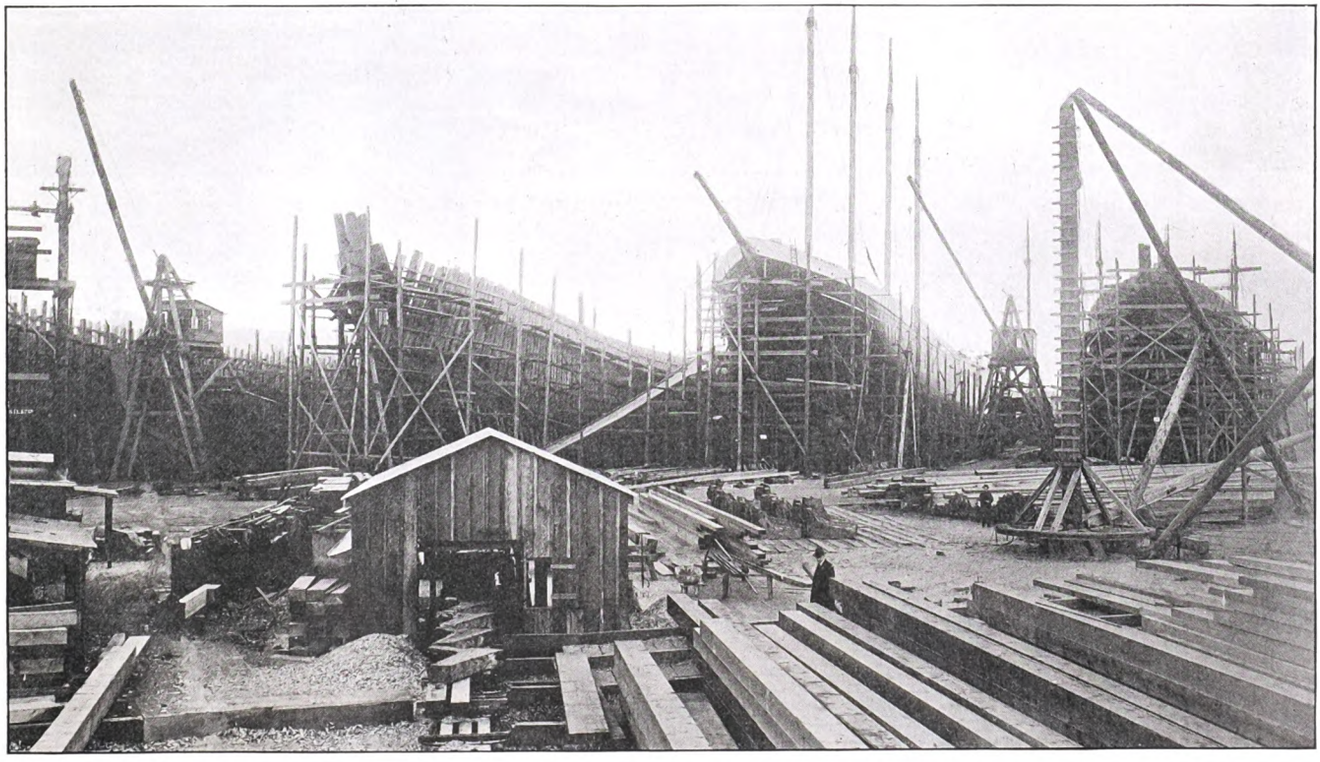

FIG. 24—GENERAL VIEW OF A SEATTLE SHIPYARD SHOWING BEVELING MACHINE, ARRANGEMENT OF DERRICKS, BUILDING SLIPS, ETC.

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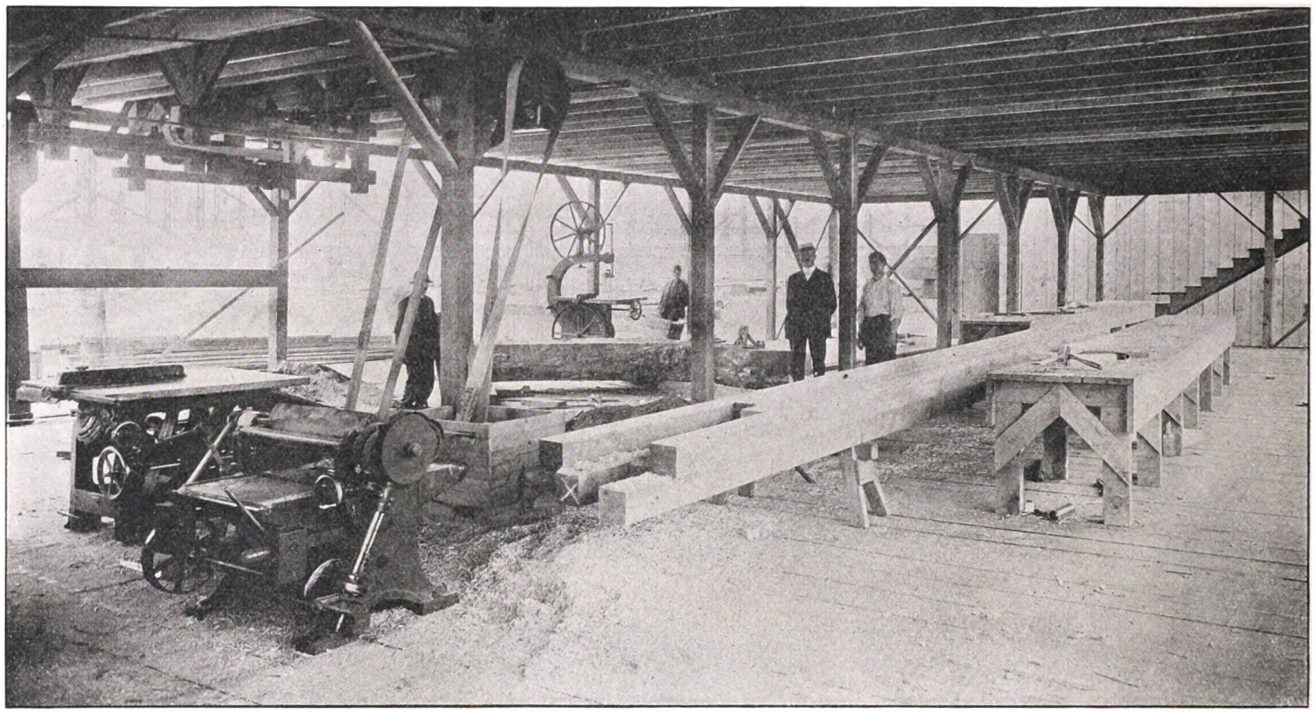
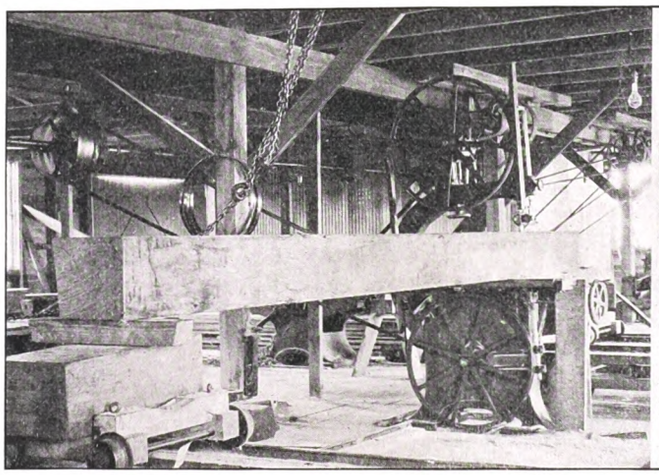


FIG. 25—WOODWORKING MACHINERY IN A PUGET SOUND SHIPYARD



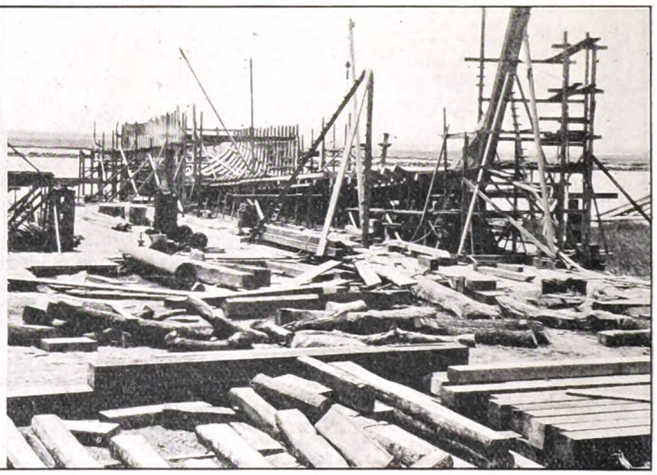
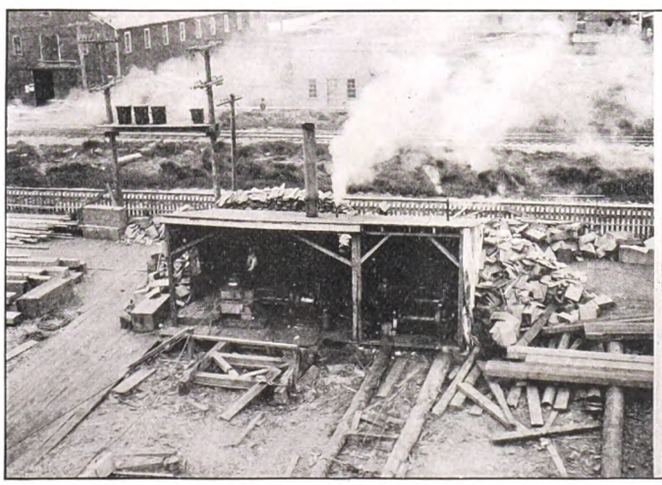


FIG. 26—BANDSAWING BEVELS IN A SOUTH ATLANTIC SHIPYARD. FIG. 27—DERRICKS AND HOISTING ENGINE IN A SOUTHERN YARD



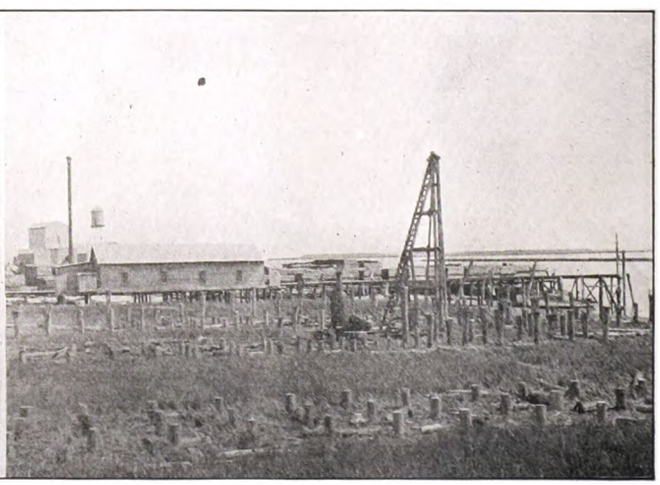


FIG. 28—TIMBER HAULING ENGINES IN A GRAYS HARBOR SHIPYARD. FIG. 29—DRIVING PILES FOR BUILDING WAYS IN A GEORGIA SHIPYARD

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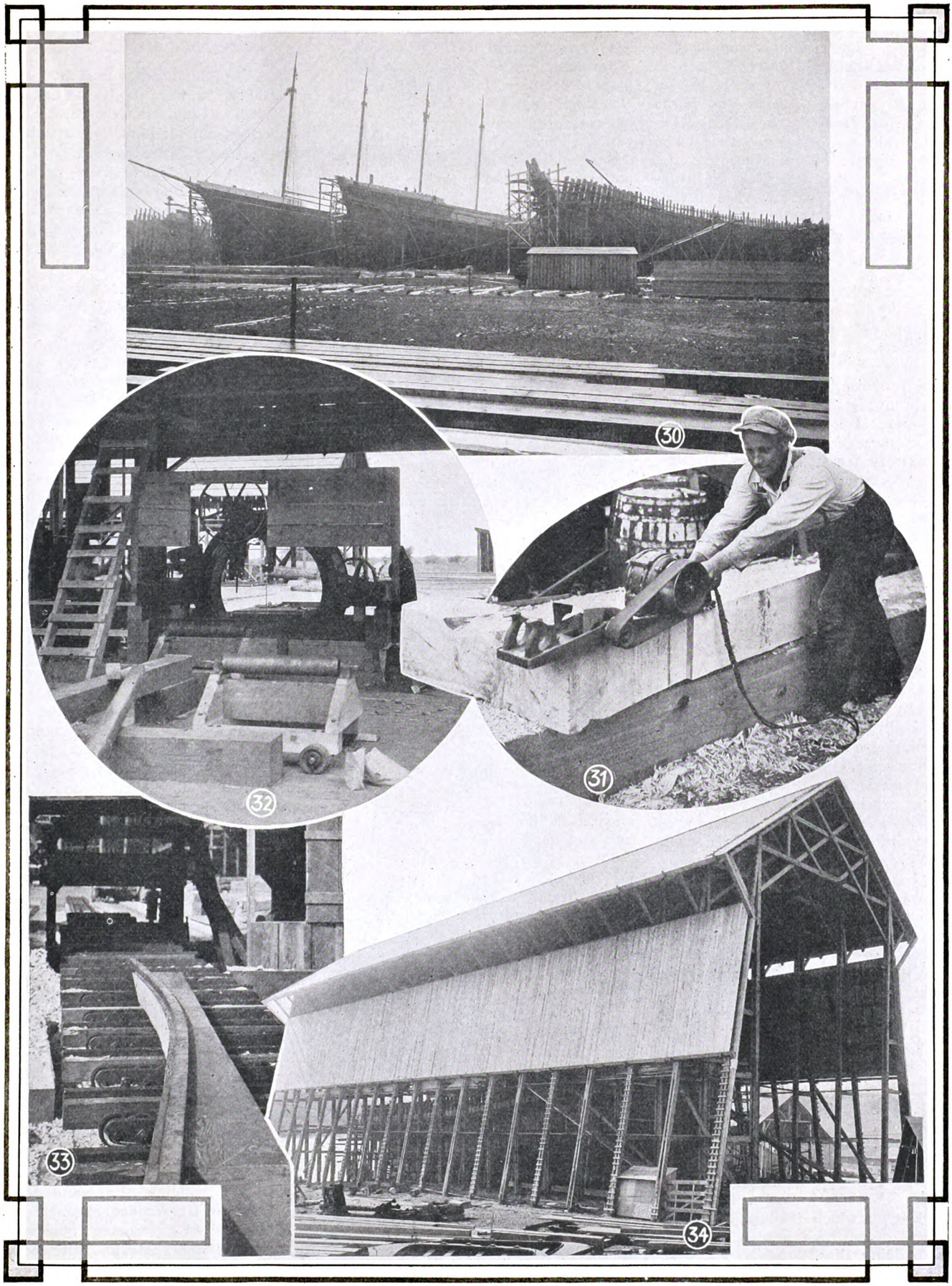

FIG. 30—GENERAL ARRANGEMENT OF BUILDING WAYS SHOWING VESSELS IN VARIOUS STAGES OF CONSTRUCTION. FIG. 31—PORTABLE ELECTRICALLY DRIVEN PLANER. FIG. 32—BAND SAWING EQUIPMENT IN A PACIFIC COAST YARD. FIG. 33—TRAVELING TABLE FOR HANDLING TIMBER AROUND MACHINES. FIG. 34—A BUILDING SHED PROTECTS THE WORK FROM THE WEATHER

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hoisting engine with a vertical niggerhead for handling the manila haulback line. The steam is supplied by a vertical donkey boiler 5 feet in diameter and 8 feet high. It carries about 80 pounds pressure and burns wood refuse from the yard that otherwise would go to waste. Almost the whole expense of operating this rig, therefore, is the wages of the engineer, $4.50 per day. A ½-inch wire rope is used for hauling the timbers. This equipment serves three hulls handling all the timbers for frames, keelsons, ceiling, etc. The cost of such an outfit should not exceed $1500. Frequently second-hand contractor's equipment is purchased at low prices. The services of the donkey engine are usually supplemented by a few rough timber derricks, as shown in Fig. 27.

In more elaborately equipped yards, and in most cases where thoroughly satisfactory results are desired, some form of crane equipment is provided. In cases where there are building sheds, rope or electrically driven I-beam monorail hoists running the full length of the shed have been found to fill the bill. Where the work is out in the open, traveling cranes of the types shown in Figs. 16 and 21 are most frequently employed.

Two Types of Cranes

Both of these cranes were designed specially to meet conditions in wooden shipbuilding yards. The main framing of the crane shown in Fig. 16 is wood; the one illustrated in Fig. 21 has a steel frame. Both cranes are simply variations of the traveling derrick.

The timber-framed derrick shown in Fig. 16, sometimes called a "monstrosity", has a boom 72 feet in length, set on a base 30 feet above the ground. It will handle 7 tons, and might be termed a shear legs on wheels. It is electrically operated, the power being supplied through a looped, insulated cable that slides on a wire stretched alongside the runway. To give the machine stability, the hoisting machinery is placed on the lower of the two platforms shown in Fig. 16. A 50-horsepower motor geared to a 3-drum hoist is provided. The hoist also is equipped with a small niggerhead for skidding light timbers. The operator's cab is on the upper platform, at the foot of the derrick. The foot-spread, or gage of track on which the crane runs, is 35 feet. One such crane will serve two building slips.

The crane shown in Fig. 21 is mounted on a turntable that permits the boom to swing through 360 degrees, an advantage the timber-framed traveler just described does not possess. The boom in the case of the revolving crane shown in Fig. 21 has a reach of 50 feet.

For handling light timbers in single pieces, ordinary lumber dollies and wide-tired four-wheel trucks are used in great profusion in wooden shipyards. These vehicles usually are of the simplest character, consisting of nothing more than a timber frame to which the wheels and axles are bolted. They may be moved by man power, although horses are usually employed. In some of the more progressive yards, small gasoline-driven tractors have been introduced, making it possible to handle the lumber trucks in trains.

Woodworking Machinery

The equipment required for working-up timbers, including the band saws, cut-off saws, jig saws, planing machines, automatic beveling machines, etc., must be carefully arranged so the work can be gotten out expeditiously with a minimum of rehandling. There are two general methods of arranging this equipment. In some yards it is grouped together in a mill located, usually, at a convenient point in front of the building ways. In other yards, the apparatus is scattered among a number of small saw sheds, on the unit principle. In the latter case, each building slip is provided with an individual saw outfit, located, generally, at the head of the ways. A mill in which all the sawing equipment is grouped together is shown in Fig. 22. A pair of individual saw sheds of the unit type is shown in Fig. 23. In this illustration, the cut-off saw, with derrick and hoisting engine for handling timbers, is in the background, with the band-saw shed, in which the curved frame sections are shaped, in the right foreground. The simple and inexpensive character of the equipment is clearly shown. A searchlight for night work is mounted on the band-saw shed.

In order to give a concrete idea of the equipment required for wooden shipbuilding and its cost, Tables V and VI are presented, giving the cost of buildings and equipment for the 3-way yard shown in Fig. 18. The prices are based on quotations in April, 1917. The equipment listed may be considered a minimum for the work to be done, and if more money were available considerable apparatus could be added, such as cranes, automatic beveling machines, etc. The total cost of the three major items is as follows: Buildings, $9280; yard work, $16,520; machinery and tools, $19,767; total, $45,567, exclusive of real estate, supplies or working capital.

Britain Orders Steam Trawlers in Canada

The Dominion government has undertaken to have built in Canada 36 steel steam trawlers and 100 wooden steam drifters, of standard British types. These trawlers will be about 125 feet long between perpendiculars, 23 feet beam and 13½ feet deep. They will have triple-expansion engines of about 500 horsepower. The work of having these vessels built has been delegated to J. W. Norcross, vice president and managing director Canada Steamship Lines, Ltd., Montreal, who is acting as director of construction, and is being assisted by three of the company's other officials, W. E. Burke, assistant manager; F. S. Isard, comptroller, and H. W. Cowan, operating manager. The orders are being distributed among existing shipbuilding plants from Quebec to Port Arthur, and it is probable that one or more plants which have not been in operation for some time will also be utilized. The materials, including engines and other machinery, are bought by the government and supplied to the builders.

Toward the end of last summer a demand sprang up in Canada for freight vessels for Norway. Between Sept. 19 and Nov. 15, 1916 the Dominion government authorized the exportation to that country on completion of 18 steel steamships, to be built at New Glasgow, N. S., Montreal, Toronto, Port Arthur and Vancouver. In addition to these a Toronto plant was authorized to export two steel freighters to the United States on completion. It appears probable that the majority, if not all, of these 20 vessels for the export of which licenses were granted, will be taken over by the British government, and it may be regarded as a certainty that, for some time to come at least no more licenses for export will be issued. In addition to the above mentioned vessels, a company is building three more of the Norwegian type, making six in that plant.

The Pacific Shipbuilding Corp. has been organized at Seattle, to construct a yard for building wooden ships. It is announced that the new plant will include six building slips, and that the keels for six wooden steamers of the standardized government type will be laid by Sept. 1. David Hollywood, formerly with the Seattle Construction & Drydock Co., the Heffernan Dry Dock Co., and later general manager of the Ames Shipbuilding & Drydock Co., has been elected president.

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American Ship Yard Activities

A Snappy Summary of the Leading Events of the Month in the Vessel Construction Field

Reinforced Concrete in Shipbuilding

THE Portland Cement association, Chicago, is calling attention to the possibility of using reinforced concrete in ship construction. In a prepared statement, the association points out that a San Francisco firm of engineers is designing a ship with a length of 330 feet, a beam of 44 feet, and a depth of 31 feet and a capacity of 4500 tons, to be built of reinforced concrete. A concrete schooner was employed for some years in the north Atlantic coasting trade, having been constructed in about 1898. The London *Times* mentions a small boat of reinforced concrete built by a Frenchman in 1849 and still in service after a test of 68 years.

Feasibility of the Plan

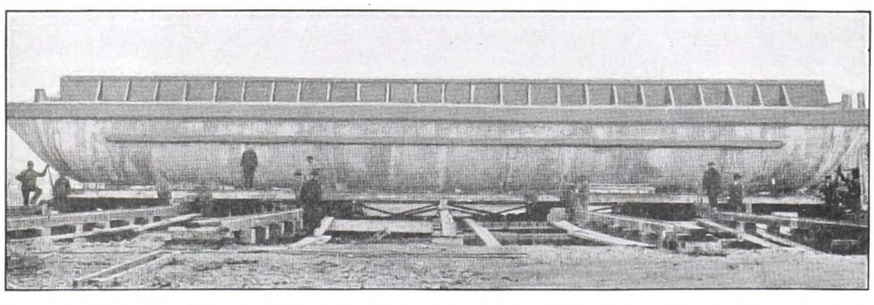
The concrete ship is only a further development of the concrete barge and such craft have been in successful use for years. Concrete lighters have been used for the past six years on Chesapeake bay, supplying coal and water to dredges, carrying loads of sand and gravel, etc. The accompanying illustration of a 500-ton lighter on the ways just before launching is typical of their appearance. With such a craft there is no necessity for caulking or painting, the upkeep is small and there is no danger of decay. Barnacles will not collect on a concrete hull.

A concrete barge has been in service on the Welland canal since 1910 and has seen very hard usage. It has a length of 80 feet, a beam of 24 feet and a depth of 7 feet. The walls which were constructed between forms are 2½ inches thick, reinforced with steel rods, yet the barge is used for carrying loads of stone, etc., with conspicuous success. Since 1910 reinforced concrete barges have been built for use on the various sections of the Panama canal and their experience has enabled the engineers to develop an efficient type of vessel. Recently concrete pontoons were constructed for service as landing stages for boats up to 65 feet in length. These pontoons have a length of 120 feet, a beam of 28 feet and are 8 feet deep. They are very thoroughly reinforced.

Vessels which are more like ships than barges have been built of reinforced concrete in Norway. A report from the American consul general at Christiania describes a plant at Moss, Norway, where vessels of 3000-ton displacement are being constructed. The following quotations from the report indicate the extent of the work under way at that time:

"The inventor of this new style of vessel is said to be M. Nicolai Fougner, an engineer, who claims to be able to construct a ship of any size demanded. He is now building a lighter for a mining company at Sydvaranger for the oversea export of iron ore and the import of coal. The vessel, having a displacement of 3000 tons, is to be ready before the end of the current year. It is stated that these concrete ships can be sailed or engined like other vessels, and experts consider that a new epoch in shipbuilding has arrived.

"The ship, which arrived in Christiania last month, resembles a large barge, and is constructed entirely of concrete with the exception of the ribs, which are of steel. . This new method of constructing ships has attracted much attention. The Swedish minister of marine, M. Brostrom, one of Sweden's largest shipowners, immediately ordered a lighter of some thousand tons displacement, and he was present when the craft was launched at Moss. He was accompanied by four experts, all of whom expressed much satisfaction over the success of the project. Two additional lighters are now on the stocks, and a large slip for a 4000-ton craft is nearly completed. More than 200 men are now working in the new yards, and five lighters have been contracted for in addition to the one completed and the two on the slips."



500 TON REINFORCED CONCRETE LIGHTER READY TO LAUNCH

Launch Big Tanker

The VIRGINIA, last of a fleet of four oil tank steamers constructed by the Fore River Shipbuilding Corp., Quincy, Mass., for the Texas Steamship Co., New York, was launched recently. Two of the fleet, the TEXAS and the NEW YORK, were completed last year and are now in service. The PENNSYLVANIA was launched two weeks earlier. Mrs. Joseph W. Powell, wife of the president of the Fore River company, christened the new steamer.

The VIRGINIA has two continuous steel decks, a raised forecastle, open bridge and poop decks, with a lower deck in the package freight hold forward. The hold is divided by oil-tight bulkheads into 16 main, oil-cargo tanks, 16 summer tanks, fuel oil tanks, two pump rooms and a cargo hold, with machinery space aft, deep trimming tanks both forward and aft, and a double bottom under the engine and boiler.

The length over all is 432 feet, the vessel having a dead-weight carrying capacity of 9100 tons. The capacity of the main cargo oil tanks is 67,930 barrels and of the summer tanks 8634 barrels. Her fuel oil capacity is 10,450 barrels.

The VIRGINIA has been designed to carry various grades of refined oil without danger of mixture. The cargo pumping system has, therefore, been worked out to an unusually high point of efficiency necessitating the use of 12 pumps—eight for the cargo in the main tanks and four for handling the oil in the sum-

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mer tanks. The vessel is propelled by a single screw driven by a 3-cylinder, triple-expansion engine, steam being supplied by three single-ended Scotch boilers. These boilers are oil fired. The accommodations of the officers and crew are unusually complete.

Denman Will Ask Another Half Billion

Declaring that all that the United States shipping board feared in February regarding the effectiveness of the submarine has been realized, Chairman William Denman has announced that the board has under discussion the investment of another $400,000,000 or $500,000,000 in vessels. He claims that the present appropriation of $500,000,000 will not replace in 18 months, the period over which the present shipbuilding program extends, more than four-fifths of Germany's destruction since Feb. 1. It is to America, he points out, that the forces fighting Germany must look for the bulk of the replacement of the submarine's destruction.

It is clear, Mr. Denman says, that the board will shortly close contracts involving the expenditure of $500,000,000 voted by congress for constructing wooden and steel ships, principally the latter. The steel vessels are to be fabricated largely under the plan suggested by Secretary of Commerce William C. Redfield some three years ago. Mr. Denman implies in his statement that in the future steel shipbuilding will have to be limited, owing to the filled-up condition of the steel mills and ship yards.

"The vast resources of quick wood construction are still far from exhausted," he says. "We need wooden vessels, of both slow and fast speed. The slower can relieve our coastwise congestion and our car shortage. They can obtain our hemp and jute and grain bags and nickel and manganese and rubber from the Far East and from South America, and release faster vessels for the North Atlantic trades. All those products and a number of others are necessary for food production, or for basic war materials. Many wooden vessels can be built which are faster than the majority of vessels now crossing the war zone. Large seagoing wooden barges can be constructed, to be towed along our coast to further relieve our coastwise trades and the shortage of railway transportation facilities."

In his review of conditions which he states have led to the board's proposal to ask for another appropriation of $500,000,000, Mr. Denman says:

"In the latter part of February, and several weeks before the war, the shipping board, forecasting a growing efficiency in the German submarine, began to develop its program for a very great increase in the tonnage output of American yards. It sought contracts with the various steel shipbuilding plants, but found that, on account of the large steel commitments to other purposes, it could not hope for any great increase of tonnage from that source.

"The board, after nearly two months' investigation into the possibility of wood ship construction to supplement steel, prepared a project for the construction of a wooden fleet which would increase the sum total of tonnage without interference with the steel supply. It called a conference of all the wooden ship constructors on the Atlantic coast, and some from the Pacific. It consulted many practical workers in wooden construction, such as in drydocks, bridges, etc., various scientists skilled in wooden material, naval constructors, and even builders of steel ships. Among others who approved the project in its preliminary form were General Goethals, F. W. Sprague, graduate of Annapolis, and noted electrical engineer, Capt. W. H. Stayton and Rear Admiral Wainwright, U. S. N., retired; F. W. Wood, ironmaker and shipbuilder; I. N. Hollis, graduate of Annapolis; Herbert Hoover and W. L. Saunders, engineers.

"As a result of this careful investigation, it prepared a report of its project, with the suggestion that General Goethals should be asked to manage it. This was turned over to the council of national defense, which, after a further investigation, approved it and returned it to the President. The President then gave his approval, and adopted the board's suggestion that General Goethals be made the manager of construction, and he was employed by the board in that capacity.

"Mr. Willard, chairman of the advisory commission of the council of national defense, suggested that from his investigation of the car steel plate situation, he believed that there could be obtained enough to build many more ships, but that the distribution of material would have to be altered. The board, upon further investigation, came to the same conclusion. It went further than Mr. Willard's suggestion and gave public notice that it intended to ask for power in the government to commandeer the steel producing plants, following the system adopted by the British government. Certain of the large steel producers thereafter requested the board that there should be a discussion of the question, and Chairman Denman asked General Goethals to take the matter up with Mr. Farrell, president of the United States Steel Corp. Mr. Farrell offered to supply to the board a very large amount of steel plate, far more than the facilities of the yards could hope to handle under the highest stimulation possible."

Build Tanker on Lakes

The oil tank steamer REGINOLITE was launched at the yards of the Collingwood Shipbuilding Co., Ltd., Collingwood, Ont., on June 21. This vessel is being constructed for the Imperial Oil Co., Toronto, Ont. She is the fourth of a group of five sister ships which will be added to the fleet of the Imperial company. The REGINOLITE, which is intended entirely for ocean service, is 250 feet in length between perpendiculars, 259 feet over all and 43 feet 9 inches beam. She is 25 feet deep to the upper deck and has a deadweight carrying capacity of 3500 tons. She will be propelled by a set of triple expansion engines with cylinders 18, 30 and 50 inches in diameter, by 36-inch stroke. Steam is supplied by two Scotch boilers working at 180 pounds per square inch pressure. The boilers are 13½ feet in diameter and 11 feet in length. The REGINOLITE has been built under the supervision of Capt. W. R. Henderson, marine superintendent for the owner.

Canadian River Steamer

The stern-wheel steamer NIPAWIN, building for the Ross Navigation Co., Ltd., Le Pas, Man., Can., was successfully launched from its yard on June 16. She was the first boat of this kind to be built and put in service at Le Pas. The steamer is 100 feet over all, 20 feet beam, and 4 feet 6 inches deep. She is fitted with one pair of stern-wheel engines, 8 inches in diameter and 42-inch stroke, and a dry-back Scotch boiler 6 feet in diameter and 8 feet long, carrying steam at 150 pounds pressure. The vessel will have accommodations for 30 passengers and a carrying capacity of 30 tons of freight on a 2-foot draft.

The boat will be used in the passenger and freight traffic between Le Pas and Sturgeon Landing in connection with the mining development to the north of that point. Regular service also will be established between Le Pas and Nipawin, a prosperous farming settlement about 200 miles west of Le Pas on the Saskatchewan river.

The owners of the NIPAWIN have operated boats from Le Pas for the past eight years and at present have two steam tugs, each towing barges, hauling copper ore from Sturgeon Landing to Le Pas.

The auxiliary motorship JANET CARRUTHERS was launched June 28 at the North Vancouver, B. C., yard of the Wallace Shipyards, Ltd.

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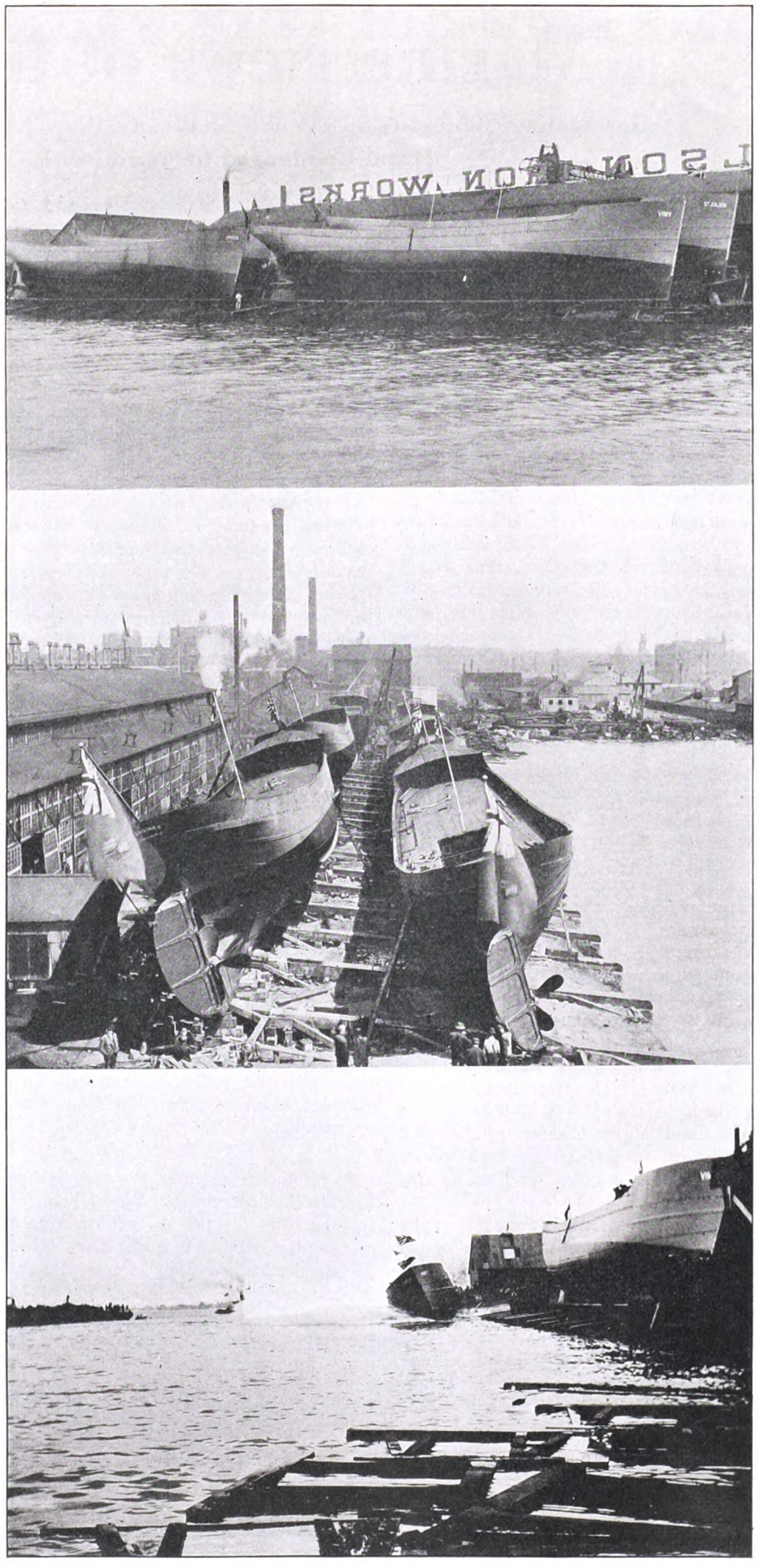
Launch Four Vessels in One Day

Four vessels were launched on June 16 at one Canadian shipbuilding plant. Two other sister ships were launched two weeks later. The six keels had been laid down just 12 weeks prior to the first launching. The boats, which will operate in connection with Canada's fisheries, carry names which are indelibly engraved in the dominion's military history — YPRES, VIMY, MESSINES, ST. JULIEN, ST. ELOI and FESTUBERT.

The boats were built by the Polson Iron Works, Ltd., Toronto Ont. They are 140 feet in overall length, 23 feet 6 inches wide and 13 feet 6 inches in molded depth. They carry fore and aft compound surface condensing engines, with cylinders 18 and 38 inches in diameter by 24-inch stroke, developing 500 horsepower. The boiler equipment is of the Howden water tube type, with down draft, and working with steam at 180 pounds pressure. These ships are the first Canadian-built vessels to be equipped with this type of boiler. The boats are fitted with electric lights, are steam-heated and have evaporating outfits fitted complete for salt water service. The machinery, boilers, auxiliaries, spars, booms and joiner work were all ready for installation. The company by delivering the boats in July anticipated the contract delivery date by about two months.

The Polson company also is building ten 3500-ton deadweight steamers, all of the same type, for ocean service. The last of these boats will be delivered before the close of the lake season of 1918. These ships are 261 feet long, 43 feet 6 inches wide and 22 feet 11½ inches deep. They carry triple expansion surface condensing engines, with cylinders 20½, 33 and 54 inches by 36-inch stroke, developing 1250 horsepower. Each steamer carries two Scotch marine boilers, 14 feet in diameter and 12 feet long. These freighters carry electric plants, searchlights, cargo winches, steam windlasses, steam and hand-steering gears and 15-ton evaporating outfits.

The volume of work at the Polson yard has necessitated additions to the buildings and equipment. A boiler shop, 250 x 90 feet, is being built. It is of steel and concrete construction and will be modernly equipped. When this building is completed, the present boiler shop will be refitted as an extension to the machine shop and engineering department. A new 10-ton gantry crane is being erected on the east side of the dock, which makes it possible to lay down four 3500-ton deadweight vessels at the same time. Two additional storehouses have been built, one for storing lumber and the second for auxiliaries and parts purchased outside.



FOUR BOATS READY TO LAUNCH IN ONE DAY. THE OTHER TWO WERE LAUNCHED TWO WEEKS LATER. THE KEELS WERE LAID ONLY TWELVE WEEKS PREVIOUS

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Marine News of the War

Interesting Sidelights on the World War Gathered During the Past Month and Condensed for the Busy Reader

THE shipping board has issued a call for engineers to serve on the new war fleet of the merchant marine. Not less than 5000 additional engineer officers will be needed on American ships in the next 18 months. Anticipating this demand, the board will establish marine engineering schools, in which to train men not now qualified to receive papers, with terms to begin on July 21, at the Massachusetts Institute of Technology, Cambridge, Mass.; Stevens institute, Hoboken, N. J.; the Case School of Applied Science, Cleveland; the Armour Institute of Technology, Chicago; Washington university, Seattle; and Tulane university, New Orleans. Each term will last one month. The expense of tuition is borne by the shipping board. The Massachusetts institute can put through 150 students a month, and the other institutions an average of 35.

Marine engineers of all grades, oilers and water tenders, and stationary engineers, are eligible for the classes. As the rules of the steamboat-inspection service, covering qualifications of applicants for examination, have been recently modified, the board expects a response to its call from all parts of the country. After passing their examinations, engineer students will be given an opportunity for further training under service conditions, until wanted on ships of the new merchant marine.

The board is also recruiting for the merchant service 5000 masters and mates, and is establishing a chain of schools in navigation on both coasts to train those needing preliminary instruction.

"Any citizen who knows the name and address of a seafaring man, active or retired, who might become a watch officer in the merchant marine, or of any engineer who might qualify," said Mr. Denman, "will render a patriotic service by sending the name to the board's director of recruiting, Henry Howard, at Boston."

* * *

As an indication of the burden being carried by Great Britain in furnishing ships for her allies, it has been pointed out since the French commission arrived in the United States that Great Britain is exporting 2,000,000 tons of coal per month to France at the present time. This one item alone requires the constant service of 200 2,000-ton vessels. The coal cost $30 to $40 a ton delivered at the French ports. The shipping experts of the allies are very anxious to be relieved of this burden and some of them have stated that it is even more essential to obtain coal supplies from the United States than food or men. In fact, shipping experts do not view the prospect of sending a large American army to Europe hopefully. It is pointed out that it would require 20 tons of shipping per man to transport an army to Europe. After the American forces have arrived on French soil, the continuous service of eight tons of shipping per man would be required to keep the army supplied. In other words, an army of 1,000,000 men would require the constant services of 8,000,000 tons of ships, nearly one-half of the total shipping under the British flag. A small expeditionary force of 100,000 men would require the servicce of 800,000 tons of ships, equal approximately to the combined tonnage of all the German vessels seized in the American harbors.

* * *

Umberto Pugliere, an Italian naval engineer, has designed a new type of unsinkable cargo boat which has been accepted by the Italian ministry of marine. The vessel has a displacement of 10,300 tons and can carry 5800 tons of cargo. It has a double skin, the space between the inner and outer hulls being filled with coal and other material which is intended to protect the ship from mine or torpedo.

* * *

A resolution recently adopted by the French chamber of deputies calling for an increase in the French merchant marine and placing it under the control of one department, was accepted by the government. The resolution, signed by 44 members of the merchant marine committee, invited the government to centralize the work of building, buying and chartering merchant ships, a task which has been up to the present divided among several ministers.

Louis Nail, under secretary for the mercantile marine, answering criticisms, said the French merchant fleet was 2,500,000 tons at the beginning of the war and since that time had lost 560,000 tons, 460,000 by acts of war. During the same period 680,000 tons had been built or bought and another 140,000 was on the stocks, so that the fleet was actually greater now than before the war. Secretary Nail then pointed out that Germany had lost 2,500,000 tons, 50 per cent of its entire fleet, and declared that reports that Germany was building hundreds of ships were mere bluff.

* * *

A mine-sweeping device calculated to pick up and safely bring to the surface any mines that may be in the path of vessels is now being attached to a number of ships proceeding through the waters of the war zone. One of these devices was observed on a liner which arrived at an Atlantic port recently. It is attached to the bows and when let down a netted projection extends a considerable distance on either side of the ship. If a mine is encountered it is picked up and brought to the surface at a safe distance from the vessel. The ship to which the device was attached was on her first trip since April, when she was compelled to seek a drydock in a British port on account of damage from a mine.

* * *

The Root mission to Russia probably will visit Japan on its return to the United States. The most important subject likely to come up at conferences between the Root mission and the Japanese government is that of shipping. Japan is ready to furnish bottoms for the use of the allies, but desires that when she does so she shall be permitted to obtain shipbuilding materials from England and the United States. Baron Den, Japanese minister for communications, recently said that, while no official negotiations were in progress concerning joint shipbuilding by Great Britain, the United States, and Japan, yet if England and America should supply the needed materials for shipbuilding Japan would be able to build ships for them by extending the Japanese docks.

* * *

The United States has bought the three Austrian merchantmen interned in New Orleans harbor, and they are at the Algiers navy yard, undergoing repairs. They are ANNA, 1000 tons; CLARA, 2541 tons, and THERESE, 2381 tons. LUCIA, 6744 tons, was interned at Pensacola, Fla., and later purchased by the government. The price paid was about the prevailing price for similar ships before the war.

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New York—Entry Port for Iron Ore

Increasing Imports of Iron Ore Demand Modern Facilities for Handling the Enormous Shipments—New York Was Selected as Site for Largest Tidewater Ore Dock

IMPORTS of foreign iron ore by eastern steel companies in recent years have reached such a tonnage and their future growth is so plainly assured, that modern facilities now are being provided for the most efficient and rapid handling of these shipments at tidewater. The most important illustration of this development is furnished by the construction jointly by the Bethlehem Steel Co. and the Lehigh Valley railroad at Constable Hook, N. J., in the New York harbor, of a new ore dock for the unloading of ocean-going vessels. This dock is of special design and will be the first of this type of equipment to be built in the east. Many of its features, however, will parallel the familiar units of this kind at the lower ports of the Great Lakes. This dock now is ready for operations. Because of this, New York, for the first time, will become an important port of entry for iron ore.

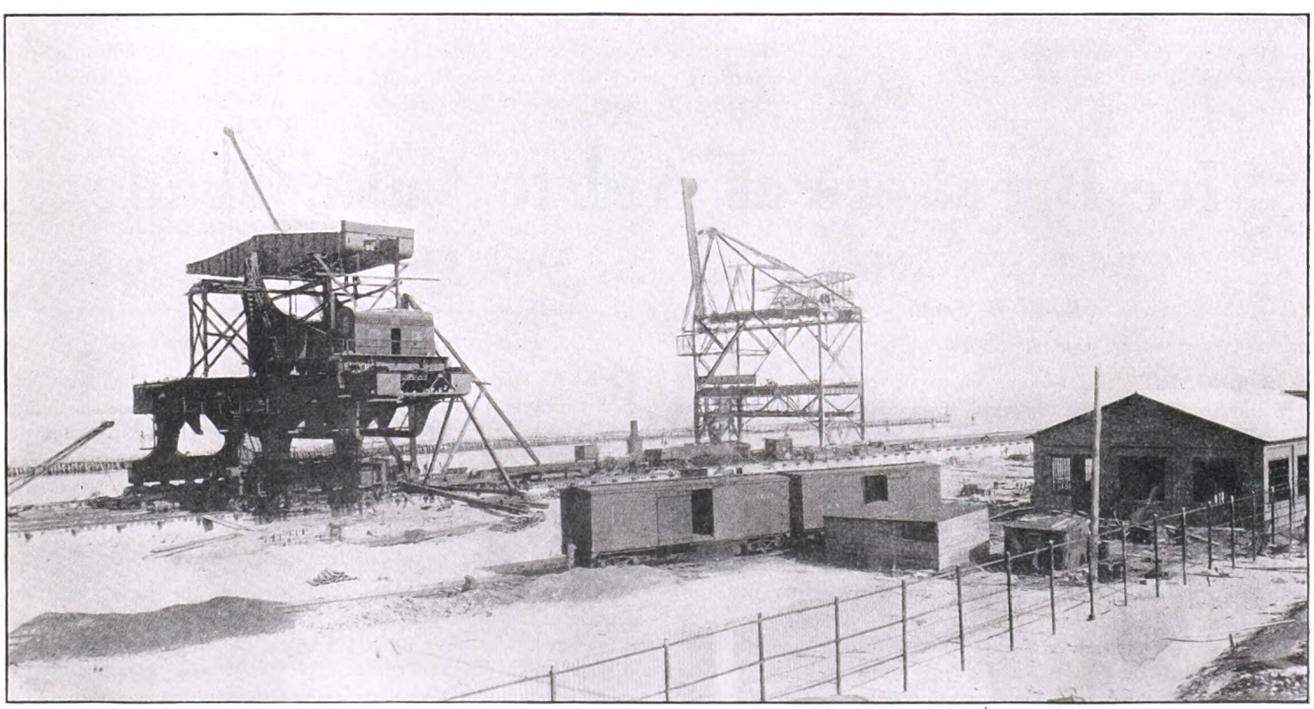
The Bethlehem Steel Co., since its recent absorption of the Pennsylvania Steel Co., which carried with it the control of the Spanish-American Iron Co., by far the largest iron ore producer in Cuba at present, is the leading consumer of foreign ore in this country. The Cuban properties of the Spanish-American Iron Co. and those of the Juragua Iron Co., previously owned by the Bethlehem Steel Co., shipped to the United States in 1915, about 765,000 tons of ore, which barring 1914, was the smallest year since 1908. In addition, the Bethlehem Steel Co. is developing large ore deposits at Cruz Grande, Chili, from which it imported 146,000 tons in 1915.

General Description of Dock

This unloading plant consists of an electric substation, a machine shop, one Hulett automatic unloader of the stiff-leg type, and a Mead-Morrison unloader having a grab bucket operated by the rope system. Two types of ore unloaders were installed on account of the various types of boats that will be unloaded. The Hulett unloader is especially adapted for unloading modern ore boats with many large hatches while the Mead-Morrison machine can operate advantageously in tramp steamers having restricted openings.

The unloaders operate on 62-foot, 11-inch runways extending the entire length of a pier 1,060 feet long. The pier is provided with four railroad tracks under the unloaders. The slip alongside is dredged to a depth of 35 feet of water at low tide and is connected with the main ship channel to New York harbor by a channel 35 feet deep, 250 feet wide at the bottom and 1400 feet in length.

The Hulett unloader operates a clam-shell bucket of 17-tons capacity which is rigidly attached to the lower end of a rotating vertical stiff leg carried by a walking beam mounted on a trolley which traverses a runway on the main frame. This main frame is propelled along the pier to line up with the cargo hatches of a ship being unloaded. The bucket discharges its contents into a 50-ton hopper which is located at the slip end of the main frame. This receiving hopper discharges by motor drive into a 30-ton scale hopper mounted on a larry car which travels on a runway on the main frame so as to register the scale hopper directly above the railroad cars on any of the four tracks. This weighing arrangement insures all cars being loaded to their full carrying capacity. The operating range of this machine is such that the bucket can extend 66 feet from the face of the wharf, 44 feet above and 10 feet below the water at low tide. All of the operations of lowering and hoisting, opening and closing the bucket, rotating the bucket leg, trolley traversing and moving the machine along the dock, are under the control of one operator who is located in the bucket leg just above the bucket. In this position the operator travels with the bucket and is thus enabled to have an unobstructed view of it at all times.



GENERAL VIEW OF THE UNLOADING DOCK OF THE BETHLEHEM STEEL CO. AT CONSTABLE HOOK, N. J., UNDER CONSTRUCTION

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The weighing and discharging of the ore into cars, is under the control of another operator, located on the traveling larry car. The total weight of the Hulett machine is 850 tons, carried on 48 wheels. The horsepower required for the equipment is as follows: Hoisting, 300; trolley traverse, 100; bucket operating, 100; bucket rotating, 30; receiving hopper, 100; larry travel, 30; larry hopper, 30; propelling gear, 100. All the power for each element is contained in a single motor.

This machine will average one trip per minute, handling 17 tons per trip when working in the hold of a ship with no obstruction to the free action of the bucket.

The 6,000 pounds over-balance of the walking beam on this machine allows the bucket to lower by gravity. This gives a low power consumption per ton of ore handled, as the walking beam is nearly balanced. The bucket has a long reach for scraping the bottom of a boat in cleaning up. This installation at Constable Hook is the first of its type on tidewater. Some modifications were required to adopt this machine to unload ocean-going tramp steamers, as well as modern vessels with open holds, such as are now being built by the Bethlehem Steel Co. The unloader was furnished by the Wellman-Seaver-Morgan Co.

The Mead-Morrison rope system unloader operates a 5-ton rope-suspended clam-shell bucket. This machine employs a hinge type of boom of sufficient length to allow the bucket to reach 60 feet from the face of the wharf. The overhead clearance is 58 feet above the water at low tide. The bucket discharges its contents into a 50-ton receiving hopper at the front end of the machine on the main tower. Motor operated gates on the receiving hopper control the discharge of the ore into a 30-ton scale hopper, mounted on a traveling larry car, which conveys the ore to the railroad cars on any of the four tracks beneath the machine. The operator of the ore bucket is located in a stationary house near the top of the main frame at the wharf side. The rope system machine weighs about 250-tons and is carried on 40 wheels. The horsepower requirements are as follows: Hoisting, 300; trolley traverse, 60; propelling gear, 60; receiving hopper, 24; larry car travel, 11; larry hopper, 12.

This machine is capable of making two round trips per minute, 5 tons per trip when bucket has free access to cargo. This machine can use a smaller clam-shell bucket which will reach the cargo in a tramp steamer having stanchions between decks, narrow alleys along shaft tunnels, etc., which would be inaccessible to the Hulett unloader. The clam-shell bucket can be removed and a hook substituted for handling small scoop buckets where it is found necessary to shovel the ore.

Electric Equipment of Interest

The electric control apparatus on the two unloaders was furnished by the Cutler-Hammer Co., Milwaukee, and the motors by the General Electric Co., Schenectady, N. Y. The electric power to operate the unloaders is purchased from the Public Service Electric Co. of New Jersey, at 2,200 volts, 2-phase at 60 cycles. The unloaders use direct current at 250 volts.

A substation was installed to transform the alternating current into direct current. All the substation apparatus was furnished by the General Electric Co. This equipment consists of two rotary converters, each rated at 500 kilowatts, 2-phase, 60 cycle, 600 revolutions per minute, 250 volts direct current; four single-phase transformers (two for each rotary converter) each rated at 270 kilovolt-amperes, 2,200 to 180 volts, 60 cycle, oil insulated, self-cooled; and one motor-generator; fly-wheel balancer of 250 kilowatt capacity, 250 volts direct current, speed range, 550 to 720 revolutions per minute.

The armature shaft of the balancer carries a flywheel consisting of a number of steel-plate disks riveted together. This wheel weighs 12,500 pounds and when running at full rated speed, has a peripheral speed of 22,000 feet per minute.

An underground conduit system of six 750,000 circular-mil, lead covered, copper cables connects the substation with the contact rails that feed the unloaders. This contact rail system consists of two 85-pound standard steel rails, one above the other and 750,000 circular-mil, bare copper cables clamped to the rails for continuous bonds. Porcelain insulators with hook bolts through rail supporting brackets clamp the head of the contact rail and the contact shoes on the unloaders run on the under side on the base of the rails.

The machine shop equipment consists of: One Putnam 42-inch x 10-foot engine lathe; one Reed Prentice 16-inch x 4-foot lathe; one 32-inch shaper; one 5-foot radial drill; one 31-inch sliding-head drill press; and one double-ended emery grinder.

Each machine tool is equipped with individual motor drive for 2-phase, 250-volt, 60-cycle current, which is supplied by two 15 kilo-volt-ampere transformers in the substation. The rotary converters will operate only when the unloaders are in operation. The complete lighting is for 250 volts alternating or direct current. A one-story brick building contains the machine shop, office, store room and substation.

Ice Breakers as Aid to Lake Trade

A Too Expensive Task

By W. H. Smith

Manager, Canada Atlantic Transit Co.

AS REGARDS the keeping open of channels and ports in the early spring it would seem to me that unless the underwriters change their policies to cover ice damages in April, owners would not be justified in incurring any expenditure for keeping open the channels unless all ports were kept open both on the Canadian bay ports as well as Buffalo, Soo, Duluth, Fort William and White Fish bay.

Any task of such a character as the one outlined would be quite a large one, and would be found, in my opinion, to be too expensive.

There are a number of years when steamers could operate from April 15 without damage or much trouble from ice and unless all ports are kept open it would in my opinion be quite a problem to divide the expense and cost of upkeep to perform this service.

Would Give Material Assistance

By H. W. Thorp

General Manager, Goodrich Transit Co.

RELATIVE to combating ice conditions at the Soo, Buffalo, Duluth and other ports which are icebound during winter months, this company operates steamers the year round on Lake Michigan and has done so for many years. Naturally, we have had considerable experience with ice conditions.

Answering question No. 1 we believe that it would be impossible to get enough icebreakers to keep the Soo in such condition that boats could pass through the locks with any degree of certainty, if at all. At any rate, in view of our experience, we think it extremely doubtful as to there being any practical means of doing this, if you mean all year.

Question No. 2—Whether or not it would prove economical to station ice-breakers at the Soo, and possibly at Buffalo and Duluth, to be in active service in time to open the

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season on April 15 each year and keep the channels clear, we are not prepared to say. However, except under exceptional conditions it would seem as if ice-breakers stationed at these points would be of material assistance, and, in normal years, be the means of opening navigation somewhat earlier than by trusting to the whims of Nature.

Question No. 3—We presume that the initial expense and cost of upkeep should be charged to those steamers that would be benefitted thereby.

Navigation Can Be Opened

By Capt. B. T. Haagenson

Ashtabula, O.

NAVIGATION may be opened on schedule with the use of ice breakers. The expense of this will not be very great. Any of the whaleback steamers, because of their peculiar bow, are available for this use. All that is needed is to equip such as are wanted for ice breakers with a rolling or oscillating plant. Such an oscillating plant can be placed aboard in one or two days and removed in a like period.

It might be interesting to readers of THE MARINE REVIEW generally to know that an oscillating plant is now being installed on the steamer MAITLAND No. 1, a carferry, operating out of Ashtabula. This is installed with a guarantee that it will keep the boat in operation on the route between Ashtabula and Port Maitland, Ont., all year, if so desired. The ordinary ice breaker as heretofore used is merely a vessel employed as a wedge, but in the case of the vessel no blow can be struck. It is merely a wedge to push ahead into the ice mass. Let us now consider a case where the ice breaker could be oscillated or made to roll in time with her natural period. This will convert a vessel which was hitherto a wedge into a piercing tool, in that, by means of its oscillations, it has a semirotary motion, the propelling power providing the pressure.

Difficult Condition to Overcome

By H. W. Reade

Vice President, National Transit Co., Escanaba, Mich.

RELATIVE to the possibilities of controlling the shipping season on the Great Lakes by the use of ice crushers or other means, in an ordinary season, we believe, it would be possible to break up the ice and open a channel a few days earlier than the ice naturally goes out. But this spring the question has not been so much one of solid ice as of shifting ice, which has piled up in great windrows on account of the fact that the wind has been in the north for practically 60 days. This is a condition which, we believe, would be difficult to overcome.

We believe the movement of ore could be facilitated very considerably if a good share of ore from the Gogebic range were handled through Escanaba instead of Ashland. This port was entirely free of ice for some weeks before much ore was shipped from Ashland. We would estimate that boats plying between Escanaba and Cleveland could make at least four more round trips in an average season than from Ashland to Cleveland. This is not only on account of the longer shipping season at this port, but on account of the very much greater distance which the boats are required to travel, and the time lost in going through the river and locks.

There is practically no hazard in shipping ore from Escanaba to Lake Erie, and the increased shipments from this port would show a very considerable saving in lives and property, as well as a decrease in insurance rates. We think this is a point well worth considering.

Ice Crushers of Great Assistance

By A. Leslie

General Manager, Marquette & Bessemer Dock & Navigation Co., Walkerville, Ont.

IN REGARD to the earlier opening of navigation, we operate between Conneaut Harbor, O., and Port Stanley and Rondeau, Ont., so that this does not interest us. Our difficulties are around the harbors and had we ice breakers at the ports we believe we would have no difficulty in operating through the winter months. Ice crushers at the Soo and the larger ports would no doubt be of great assistance in the earlier opening of navigation.

Would Not Be Profitable

By Robert C. Pringle

President, The Pringle Barge Line Co., Cleveland

REGARDING ice crushers at Soo, Buffalo and Duluth, my opinion is that in normal times it would not be profitable to attempt to open Soo river channel and Duluth harbor much earlier than natural conditions would. We have to contend with not only the harbors, but Whitefish bay and the head of Lake Superior, where heavy windrowed ice is usually found, and channels would close up just about as fast as the boats could pass through them. Such channels as Soo, under freezing conditions, would keep filled up by the current carrying the broken ice down the stream until it was packed from the bottom of the river to the surface, and for several miles in extent —a condition which it is almost impossible to combat successfully.

As to who should bear the initial expense, it would be hard to say. I think it should be borne proportionately to the benefit received by every boat using such channels during the time ice crushers were required to keep them open.

Asks Aid for Foreign Trade

In an appeal to Chairman Denman, of the United States shipping board, the Merchants' Association of New York says freight rates have reached such prohibitive figures as to make it practically impossible to retain foreign trade. Secretary S. C. Mead's letter to Chairman Denman reads, in part:

"Consignments to such neutral countries as those in South America and the Orient are asked to pay charge so high as to be practically prohibitive. In drawing this matter to your attention please be assured that the association fully realizes the exigencies of the present occasion and concurs fully in any policy which has for its aim the best and most complete service of the military needs of our country and our allies.

"Furthermore, we believe that every patriotic shipper will support such a policy irrespective of the extent of the loss of money and business which may result from it. We realize fully that rates have advanced because of the working out of the economic law of supply and demand, i. e., constantly decreasing available tonnage making for constantly increasing rates.

"We have been informed that the British government has recognized the necessity of arranging for a certain amount of commerce between England and South America, and that some eight steamers of the Pacific Steam Navigation Co. are still in service between England and that territory."

The association asks the shipping board to use its influence for the purpose of according facilities for Americans similar to those which these British shippers are receiving.

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Salved After Decade in Tropics

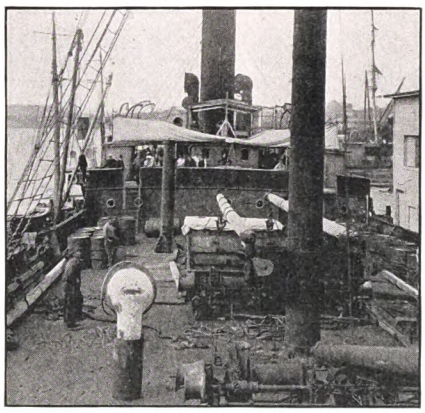
How the Old Kosmos Liner Sesostris Was Rescued From a Guatemalan Beach 10 Years After Being Wrecked in 1907

AFTER being stranded on the sands of Ocos, Guatemala, for nearly 10 years, the old Kosmos freighter SESOSTRIS has been salved and towed to Seattle for repairs, after which she will again be placed in service under the name of FRANCES L. SKINNER. She probably will be ready for the sea before July 15. She was wrecked in a hurricane off the Guatemalan coast in 1907 and was abandoned by the underwriters.

After bleaching on a tropical coast for nearly a decade, the hulk was purchased by the D. E. Skinner Syndicate, Seattle, about a year ago for $35,000. D. E. Skinner is president, Skinner & Eddy Corp., shipbuilder, Seattle. The British Columbia Salvage Co., Vancouver, B. C., landed the boat successfully in deep water for the sum of $250,000 and the salved ship was brought north under her own steam, in the convoy of a tug. It is said she can be put in good shape for an additional $60,000 and that she could then be sold for about $750,000.

A Difficult Problem

The FRANCES L. SKINNER is 380 feet long, 50 feet beam and 30 feet deep. Her gross and net tonnage is 4800 and 3026 respectively. Her speed when loaded is 10 knots. Her deadweight cargo capacity is approximately 7000 tons. Her restoration to good operating condition will present no special problems. Her salvage from the Guatemalan beach, however, was another matter.



DECK SCENE ON FRANCES L. SKINNER

She was driven ashore at Ocos, Guatemala, Sept. 15, 1907, while en route from Seattle to Europe via the Straits of Magellan. She was abandoned by the Kosmos line and for a year or more an enterprising Guatemalan used her, first for an electric light plant for the village of Ocos and later as a hotel, for she had been driven high and dry in the sand by the storm.

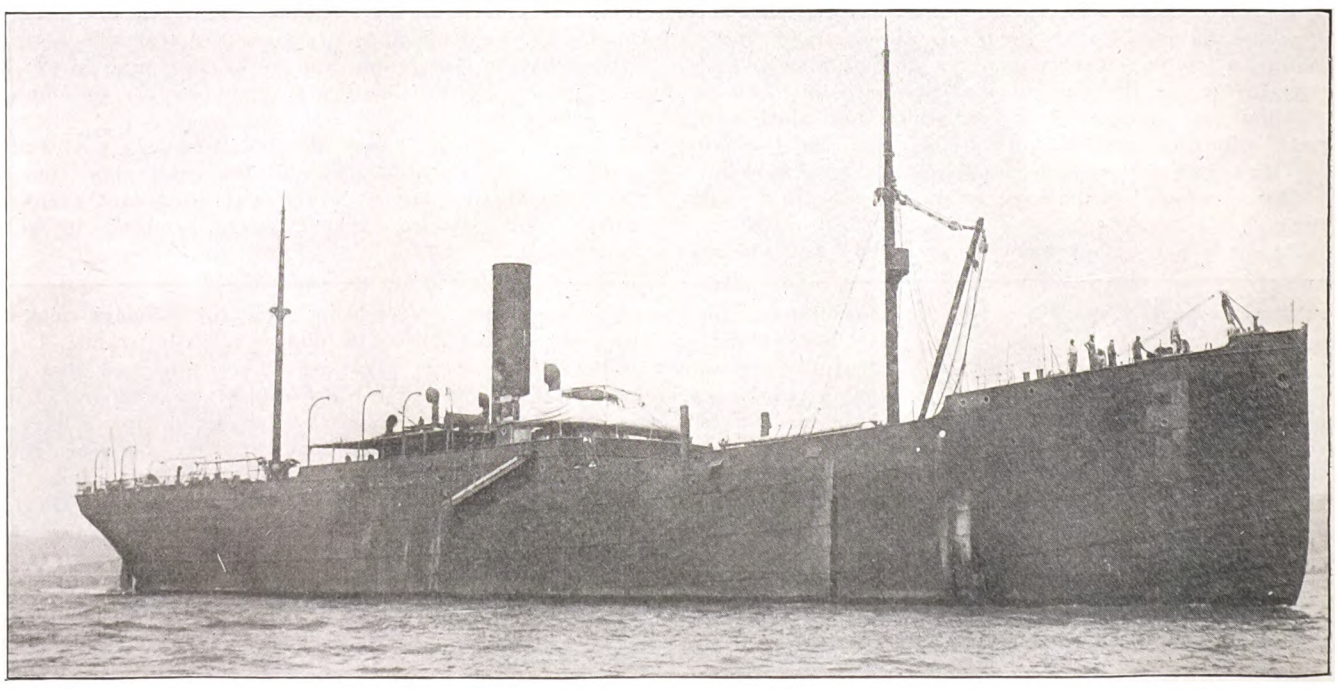
The salvage expedition of the British Columbia Salvage Co. was carried south by the British tug PILOT, commanded by Capt. F. C. Stratford. The expedition found the steamer in a small lagoon which had been formed by pumping out the sand from around the vessel, during an unsuccessful effort to rescue the steamer before the war had made cost a matter of secondary importance.

In November, 1916, Capt. W. H. Logan, Victoria, B. C., representing the London Salvage association, arrived at Ocos and took command of the job of floating the vessel. In the meantime the lagoon in which the ship rested had been enlarged and the SESOSTRIS was turned until her bow pointed seaward. Previously she had lain parallel to the shore.

Behind a Sand Barrier

Captain Logan found that between the vessel and the sea lay a huge barrier of sand. This barrier protected the steamer from the ocean, but at the same time held her a prisoner. To restore the ship to the ocean it was necessary to dredge a channel 650 feet long through the sand to deep water. The problem was made difficult by the surf that kept the sand always in motion. To restrain the surf, a breakwater was built seaward. But shifting sands were not the only difficulty; several times the expedition was hampered by earthquakes.

The space between the sandy barrier and the breakwater was not large enough for the vessel to turn in, and



STEAMER FRANCES L. SKINNER, NEE SESOSTRIS, ARRIVING IN SEATTLE AFTER A SOJOURN OF 10 YEARS ON A TROPICAL BEACH

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when she was being taken out to sea. a gap had to be cut in the breakwater. It was when the ship was half way through this gap that the earthquake took place, demolishing the entire breakwater. Captain Logan, however managed to get the vessel out to open water. This was on March 24, 1917.

In moving the steamship from the lagoon into deep water, the problem was more or less a tidal one. The absolute lack of tidal data covering the Guatemalan coast in the vicinity of Ocos, coupled with the fact that suitable tides occurred only three days a month, hampered the expedition's work greatly. It was necessary to work nearly a whole month holding the position gained during one set of tides, before getting advantage of the next set. The hot and unfavorable climate added to the difficulties. The health of the expedition, however, remained good.

The expedition found that money was scarce in Ocos and the coin with which to pay the workmen had to be brought under arms from larger cities down the coast.

The steamship made the voyage north from Ocos to Victoria, B. C., under her own steam, convoyed by the tug NITINAT of Victoria. She was convoyed from Victoria to Seattle by the salvage tug SALVOR. Captain Logan acted as commander on the voyage to Seattle, which was without incident. Comparatively little work was necessary to get the boilers and engines of the vessel ready for the voyage, in spite of their long period of inaction on a tropical coast.

Buys Lake Boats

New York interests have purchased through the Chicago Steamboat exchange the steamers UNITED SHORES, MAYWOOD and ALCOTT, which were formerly in service on the Great Lakes. The UNITED SHORES was owned in Chicago, and was in service on the Jackson and Lincoln park line; the MAYWOOD formerly belonged to the Hill Steamboat line and piled between Chicago, Racine and Milwaukee; the ALCOTT sailed out of Sandusky, O., between Put-in-Bay and Lakeside. These boats will be equipped for salt water service and will be used for coast trading.

The Norwegian auxiliary schooner H. C. HANSEN was launched recently at the yard of the Seaborn Shipbuilding Co., Tacoma, Wash. The keel was laid Dec. 27. She is a five-masted auxiliary schooner and will be driven by two 240-horsepower semidiesel engines. She is 260 feet in length, 44 feet beam and with a hold depth of 21 feet. Her lumber capacity is 1,750,000 feet. She has a 12,000-mile oil radius.

Book Review

War-Ships, by E. L. Attwood; cloth 338 pages, 5½ x 8¾ inches; published by Longmans, Green & Co. and furnished by *The Marine Review* for $4 net.

A text book on the construction, protection, stability and other features relating to the design and operation of war vessels is particularly apropos at the present time. The value of *War-Ships* to students of naval architecture who are interested in the subject from the standpoint of battleships is enhanced by the fact that the author, E. L. Attwood, R. C. N. C., is a member of the British Royal Corps of naval constructors and formerly lectured in the Royal naval college at Greenwich. The new book is a most desirable addition to the author's previous books on naval architecture and ship building.

Although *War-Ships* was prepared primarily for naval officers and has been approved for use in the British navy, it will prove a useful introduction to any student of this particular department of ship construction and design. The various chapters are devoted to practical discussions of such parts of battleships as the beams, bulkheads, steering gears, pumping equipment and armor. The author has drawn upon his experience as a naval officer and ship architect to outline the strains and stresses each part must resist and to describe the tests of materials necessary to assure endurance and strength in the completed ship. Illustrations and diagrams simplify the exposition and add to the attractiveness of the book. A great deal of the author's material was taken from design data of boats in the British navy. In addition to the technical information regarding the construction of war vessels, the book contains several chapters relating to their behavior and control when in service. A most interesting chapter is devoted to a discussion of the loss of H. M. S. VICTORIA which sank in a collision with Camperdown, June 22, 1893.

Ex-Navy Men Wanted

Thousands of men in civil life, who hold honorable discharges from the navy and desire to offer themselves again for re-enlistment with prospects of early and active service, will be much interested in the special opportunities the government is now offering them. Good ratings await ex-navy men aboard the large fleet of patrol vessels which the government's agent, the International Mercantile Marine Co., has purchased and is now outfitting. Commander F. N. Freeman, United States Navy, who heads the special board for patrol vessels, states that ex-navy men are the ideal applicants for such service, and in every way best fitted for the valuable work these ships will perform. Navy officials hope that large numbers will offer themselves in person or by letter, to the International Mercantile Marine Co., or to Commander Freeman, both located at 9 Broadway, New York.

Yachts on War Duty

In connection with the quiet campaign of preparedness which is being carried on under the orders of Franklin D. Roosevelt, assistant secretary of the navy an active effort has been under way for weeks to procure sea-going yachts for immediate war duty. Vessels of this kind must be not under 110 feet in length, with sea-going ability and a large cruising radius.

About a month ago the assistant secretary of the navy organized a special board for patrol vessels, whose duty is to secure suitable boats with all possible dispatch. One of the first moves of this board was to have the International Mercantile Marine Co., New York, designated as the official agent. This brings to the assistance of the navy the services of the International company's large staff of shipping experts, all of whom are giving their services without remuneration. The navy yards are thus relieved of a great deal of work, under this new arrangement owners also are assured of immediate payment for their boats. The International company is also supervising all alterations above and below decks, arming, outfitting, coaling and provisioning the ships and delivering them, painted in war colors, to the navy department for sea duty. The special board is acting in an advisory capacity and is preparing to man all these ships promptly. Such well-known yachts as CAROLA IV, NOKOMIS I, EMELINA, WANDERER, CORONA, ZARA, REMLIK, SIALIA and ALCEDO, have already been taken over by the government and are in process of alteration.

There is at present before congress a bill authorizing the requisitioning for this special sea service of all available boats of suitable size and other qualifications. Before this law becomes effective the special board for patrol vessels and the International Mercantile Marine Co. is endeavoring to interest yacht owners who wish voluntarily to offer their craft for service against the enemy. The work to be accomplished is of an extremely important military nature, so that any owner placing his boat at the disposal of the government will render the greatest possible service, and, owing to the arrangements with the International Mercantile Marine Co., will receive payment without delay or formality.

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On the Coasts, Lakes and Rivers

What's Doing and Who's Doing It

News of Busy Season on Great Lakes

By M. C. Lynch

SUPERINTENDENT Daniel J. Coughlin, at the Lehigh Valley coal dock, Tifft farm, established a new record for loading on June 9. He put onto the steamers WILLIAM T. ROBERTS and W. H. WOLF, 13,400 tons of coal in 11 hours. The ROBERTS took on 10,200 tons in 7 hours and the WOLF 3200 tons in 3½ hours. The two cargoes comprised 300 cars of coal. On Tuesday, June 12, Superintendent Coughlin received congratulations from the president and vice president of the Lehigh Coal Sales Co., New York, on the exceptional record which he had made the day before in loading the steamers E. L. BOOTH, LIVINGSTONE and VENEZUELA. A total of 13,800 tons of coal (310 carloads) was put into the trio of ships in 12 hours and 15 minutes. The BOOTH took 7300, the LIVINGSTONE 3300, and the VENEZUELA 3200 tons. This is said to be the fastest loading time ever made at that end of Lake Erie.

* * *

Capt. W. C. Richardson, veteran vessel manager on the Great Lakes, celebrated his seventy-seventh birthday, Saturday, June 9. He received a large number of telegrams and flowers from his friends.

* * *

The new steamer CARL D. BRADLEY cleared, Monday, June 11, for her maiden trip. The steamer was built at the Lorain yards of the American Shipbuilding Co. She is equipped with unloading machinery and a wireless outfit. She cleared for Calcite to load stone.

* * *

The new canal-size steamer TOULOUSE arrived in Buffalo harbor June 11, flying the French flag. She was the first ship to carry the French colors into that port and she was welcomed by the various tugs and steamers as she steamed down Buffalo creek to the elevator where she tied up. The TOULOUSE was recently built at the Superior yards of the American Shipbuilding Co. and brought down a cargo of 104,843 bushels of grain from Ft. William, Ont. After discharging her cargo, she proceeded to Lorain, O., to take on a load of coal for Quebec, Que. From the latter port she went to New York. The vessel is compactly built, equipped with all modern machinery and fitted out for deep sea navigation. She is manned by a crew of French and Chilean sailors and commanded by Capt. Edward K. Perry. Captain Perry said that she will prove a splendid deep-sea boat, judging by his observations on the trip down the Canadian head of the lakes.

* * *

Work on Conneaut's outer harbor will not be finished this season. The new pierhead, to replace the one that sank while being placed in position last fall, will be put in place late in the summer, but no breakwater construction will be attempted.

* * *

The following notice, relating to Chicago harbor entrance, has been sent out from the office of the United States district engineer, Chicago, to masters and pilots: "Notwithstanding the various notices issued by the lake survey, the lighthouse service and the hydrographic office, vessels continue to pass in and out to the southward of gas and bell buoy No. 1, showing a fixed white light. The entrance from the lake is north of this buoy, between it and the red light which is located on the new crib at the south end of the north arm of the breakwater. Stone is rapidly being deposited immediately south of the bell buoys and there is now only 12-foot depth over portions of it. Beware."

* * *

The sand steamer ISABELLA J. BOYCE, owned by the River Rouge Sand Co., Detroit, burned to the water's edge in Lake Erie, off the east end of Middle Bass island, June 6. In spite of the fact that the lake was so rough that large craft found it extremely difficult to give assistance, Captain McFadden and the crew escaped to Put-in-Bay island, 3 miles southeast, in small boats. The BOYCE went on a reef while making her way from Kelley's island to Detroit light, about 8 o'clock in the morning. While she was trying to release herself, flames broke out above her engine room. Two years ago the BOYCE was swept by flames in practically the same manner and at about the same place.

* * *

Injunction proceedings begun in federal court at Chicago last year by the Scranton Coal Co. against the Great Lakes & St. Lawrence Transportation Co. to force a specific performance of a 3-year contract, has been settled out of court, the defendants paying over to the Scranton Coal Co. a sum of money. A check for the amount was received June 6 by Brown, Ely & Richards, Buffalo admiralty lawyers.

* * *

The steamer A. A. AUGUSTUS collided with the steamer DELAWARE on Lake Huron, Tuesday, June 5. The AUGUSTUS had 15 damaged plates, and put into Ecorse for repairs. The DELAWARE had her bulkhead stiffened at Port Huron and then proceeded to Buffalo for repairs. She had to have 32 plates on her bows and about one dozen frames replaced as a result of the accident.

* * *

The LYDONIA was sold to the navy, June 8, by Commodore W. A. Lydon, president of the Great Lakes Dredge & Dock Co., at a price far below its real value. The LYDONIA is said to be the largest and finest yacht on the Great Lakes. She carries a crew of 28 and has luxurious accommodations. She is 181 feet long, 26 feet beam, 17 feet draft and has a speed of 15 miles. In 1911 she cost $225,000.

* * *

Owing to the obstruction caused by the wrecks of the steamers SAXONA and PENTECOST MITCHELL, the channel to the westward of Pipe island, in St. Mary's river, was temporarily discontinued on June 20. Until further notice all vessels were instructed to take a course starting northeast of the Frying Pan island light and running N. by E. 2 3/5 miles to abreast of the Pipe island twins, and thence N. W. by W. ¾ W. 7 1/3 miles to the old intersection of the two courses southwest of Lime island. In order to mark the new channel, the lighthouse inspector moved Watson Reefs gas buoy No. 5 to Pipe island shoal, and established gas buoys at the edge of the shoal northeasterly from Pipe island twins and at the southerly edge of the shoal off Squaw island.

* * *

The steamer HENRY STEINBRENNER was picked up by the tug JAMES REID a short distance above the Corsica shoal lightship, July 3. The STEINBRENNER had a disabled shoe and rudder. She was taken to the Reid dry dock for repairs. Although originally bound for Duluth with a load of coal, her destination was changed to Milwaukee.

* * *

From the office of the United States lake survey, Detroit, a new chart has been issued, showing the recently completed channel opposite Fighting island, lower Detroit river.

* * *

The Marine Iron & Shipbuilding Co., Duluth, has contracted to build three wooden ships for the government to be used as submarine destroyers. The boats are to be delivered in the fall.

* * *

The 600-foot steamer FRANK H. GOODYEAR, which was built for the Buffalo Steamship Co., started on her first trip Tuesday, June 19. Capt. John Mitchell manages the boat and Capt. Charles B. Galton brought her out. Percy Worden is chief engineer.

* * *

The Pittsburgh Steamship Co. has recently secured more land on the waterfront at Erie, Pa. The company now owns 31 lots, each having a frontage on the bay of 33 feet and a depth of 1200 feet. It also owns six acres of land just south of the waterfront.

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The officials of the company are planning on wintering a large number of the boats of the Pittsburgh fleet at Erie and a repair plant may be built at that port. The company, however, denies the report that it will build a shipbuilding plant which will cost $3,000,000.

* * *

The Canadian steamer NATIRONCO and the passenger steamer EASTERN STATES collided early in the morning of June 19. As a result, the NATIRONCO is at the bottom of the Detroit river and the EASTERN STATES was out of commission for about a week. The NATIRONCO was up-bound with coal and the EASTERN STATES was bound for Cleveland. The collision occurred at the head of Fighting island, and the NATIRONCO, which was leaking badly, was beached near the old Smith coal dock. The wrecked boat is entirely out of the channel and is no obstruction to navigation.

* * *

The freight and passenger steamer OLCOTT of Sandusky has been sold by Nelson J. Hunt, acting for the Peninsular Steamship Co. The identity of the purchasers was not disclosed.

* * *

Walter Voss, secretary-treasurer of the Lake Grain Elevating Association, died of pneumonia, June 21, at his residence in Buffalo. He was known to marine men all over the lakes.

* * *

The Orion Steamship Co., Green Bay, Wis., plans to change the name of the steamer ORION to WESEE. She is of 2283 gross tons register.

* * *

The steamer LOUIS W. HILL, built at the Lorain yards of the American Shipbuilding Co. for M. A. Hanna & Co., was launched Saturday, July 14. The HILL, named for the son of the late J. J. Hill, is 550 feet over all and has a capacity of 10,000 tons.

* * *

The new Pittsburgh steamer, HOMER D. WILLIAMS, built at the Lorain yards of the American Shipbuilding Co., cleared June 27 on her maiden trip. She loaded ore at Duluth.

* * *

The 600-foot steamer MIDVALE, built for the Johnstown Steamship Co., M. A. Hanna & Co., managers, has been completed. She was placed in commission the first week in July. Capt. P. L. Mellen brought the new boat out and B. Anderson is chief engineer.

* * *

The steamer SUSQUEHANNA, sold some time ago by the Great Lakes Transit Corp. to New York interests, left Buffalo July 3. She was taken in two sections to Quebec, where the parts were to be joined. The steamer was bound for New York.

* * *

S. O. Richardson, Toledo, has sold the gas boat JESSAMINE to the government. The ship, which is 57 gross tons, is 81 feet long and 14 feet beam. The price was not given out.

* * *

The steamer ARIZONA grounded on Vidal shoal the morning of July 5, but was released by the tug ILLINOIS by evening and taken to the Soo. The ARIZONA was loaded with lumber and 100,000 feet of lumber were lightered.

Along the Pacific

By R. C. Hill

SEATTLE is celebrating the national holiday this year by formally dedicating with elaborate ceremonies the Lake Washington canal. This magnificent work is the fruition of efforts begun in 1853, when Gen. George B. McClellan gave the project his endorsement. The canal, whose locks are capable of lifting larger vessels than any other government locks except those at Panama, connects Lake Washington with Puget sound, furnishing a splendid inland, fresh-water harbor. The canal is 8 miles in length and adds more than 90 miles to Seattle's waterfrontage. The work was done jointly by the government, state, and King county. In 1910 the government appropriated $2,275,000, excavation was begun in 1911 and since the locks were first opened to traffic 11 months ago, 17,000 craft of all sizes and description have passed through. The total cost of the improvement has been approximately $5,000,000.

* * *

Tentative proposals by H. F. Alexander, president of the Pacific Steamship Co., for withdrawing the palatial express steamers GREAT NORTHERN and NORTHERN PACIFIC from the run between Fravel, Oreg., at the mouth of the Columbia, and San Francisco, have been abandoned for the present owing to the opposition from Portland, Oreg. Mr. Alexander proposed to substitute the fast steamers PRESIDENT and GOVERNOR, now operating between Puget sound and San Francisco, and to replace them with the GREAT NORTHERN and NORTHERN PACIFIC. The plan was subject to approval by Portland people and inasmuch as it was disapproved at Portland, the matter has been dropped. The Alexander idea was to give Portland direct service by operating the GOVERNOR and PRESIDENT out of Portland instead of from Flavel. It is regarded as possible that some such arrangement may yet be made as the NORTHERN PACIFIC and GREAT NORTHERN are expensive vessels to operate and can handle an immense number of people. The rumor is also in circulation that these vessels may be used by the government as transports for which purpose they are well fitted.

* * *

Philip D. Sloan and his brother, Joseph A. Sloan, formerly identified with shipbuilding interests on the Great Lakes, are now taking a leading part in Puget sound's great building program. The Sloan Shipyards Corp. has the distinction of laying the first keels for wooden ships building on the sound to the government's order. This company has a contract from the shipping board for 16 complete wooden ships of the standard type. One week after receiving the contract, two keels were laid down at the corporation's Olympia, Wash., yard. Another yard is to be established near Anacortes. The company has received substantial financial backing in the east, Antonio C. Pessano, Detroit, being next to the heaviest stockholder.

* * *

The Seattle Construction & Dry Dock Co. is repairing the former Pacific coast liner CONGRESS, which was badly damaged by fire off this coast last September. The vessel has been sold to the Pacific Mail and close to $1,000,000 will be spent in rehabilitation. The CONGRESS has been renamed NANKING and will be operated between San Francisco and the Orient. Delivery will be made about Nov. 1.

* * *

Seventy-eight days after the keel was laid, the Norwegian steamship JEANETTE SKINNER was launched last week, she being the seventh hull turned out by the Skinner & Eddy Corp., since its yard was established in May, 1916. The JEANETTE SKINNER was built for Knut Knutsen, Bergen, Norway, and is a standard 8800-ton deadweight freighter. The speed with which this ship was built is believed to establish a record at least for Puget sound if not for the Pacific coast.

* * *

For the same owners, the Seattle Construction & Dry Dock Co. on June 7 launched the 7500-ton Norwegian freighter STORVIKEN. This was the eighth vessel turned out by this great plant since last September, the others including the CAUTO and PANUCO for the Ward line, each 6000 tons; the submarines N-1, N-2 and N-3, and the 7500-ton Norwegian steamers GOLDEN GATE and KEY WEST, sisters of the STORVIKEN. This yard is now employing more than 4000 men.

* * *

The former German steamships PRINZ WALDEMAR and LOONGMOON have arrived on Puget sound from Honolulu in tow. Both will be operated under direction of the shipping board. The LOONGMOON is being repaired by the Seattle Construction & Dry Dock Co. and the PRINZ WALDEMAR is being overhauled at the Puget sound navy yard, where also the SAXONIA, now known as the SAVANNAH, is being repaired. The former German ship STEINBEK, now flying the Stars and Stripes as the NORTHERN LIGHT, is in the coal trade between British Columbia and San Francisco.

* * *

Rapid progress is being made at Tacoma, Wash., in preparing the new plant of the Todd Shipbuilding Corp., and by Aug. 1 actual shipbuilding will be under way. A large amount of preliminary work has been necessary in reclaiming tidelands, dredging, building roads and erecting buildings. This company recently took a contract from the government for ten 7500-ton freighters of the same type as the STORVIKEN and also has a large contract from the Cunard company. Tacoma will be favored with a large amount of this work, there being sufficient contracts to keep both plants in full operation for many months. There is a well defined rumor that a large rolling mill is to be established in Tacoma, close to the Todd yards.

* * *

Mexican interests are in the market for small steamers adapted for service along the Mexican coast, but vessels of the type desired are scarce and the purchasers are having difficulty in obtaining what they require. The little steamer ISLANDER, built for Puget sound service, has just been remodeled and is

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about ready to depart for Mexican waters.

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By arrangement with the war department, the bureau of fisheries will transmit fish quotations at Seattle by cable to important Alaskan centers. The Alaskan fish industry is developing with such rapid strides that this plan will meet with general approval and will aid in making Seattle a still greater fish market.

* * *

More than ordinary interest attached to the recent performance of the auxiliary power schooner SANTINO, which logged the distance between San Francisco and Balboa in 28 days. This vessel is equipped with surface combustion oil engines, invented by H. W. Sumner, Seattle. The SANTINO was built at Grays Harbor, Wash., and purchased by Gaston, Williams & Wigmore, New York. Her power consists of two engines of 350 horsepower each and her initial performance is regarded as eminently satisfactory, this vessel being the first in which Sumner engines have been installed. The company is building 12 engines of the same type and at its Seattle factory is employing 300 men.

News from the Gulf

By H. H. Dunn

ANNOUNCEMENT has been made through the Southern Pine Emergency bureau, at New Orleans, that the federal shipping board's emergency fleet corporation has awarded contracts for several wooden ships to be built at southern yards. The Jahncke Navigation Co., Madisonville, La., is to build two of these; the Union Bridge & Construction Co., Kansas City, six, to be constructed at Morgan City, La.; and the Newcomb Lifeboat Co., Hampton, Va., four, to be built at Hampton. The emergency bureau, whose proposal to furnish complete schedules for 100 wooden ships was accepted by General Goethals recently, has forwarded schedules for the 12 of these ships which are to be built in the south.

* * *

Contracts for 20 composite type ships —steel and wood—have been taken by Messrs. Terry and Brittian of New York, but it has not been decided whether the boats will be built at Moss Point, Miss., or at Savannah, Ga. The company took options on a shipyard site at Moss Point, but later, permission was granted by the government that the construction work be done at Savannah. The company, however, has asked an extension on its Moss Point option, and a yard may be established there.

* * *

Henry Piaggio, who is building a number of wooden vessels, mostly large auxiliary schooners, at Orange, Tex., announces that he will build five large wooden ships at Pascagoula, Miss. The Piaggio company will construct a yard at the Mississippi port, where a large lumber mill has begun to cut the wood for the vessels. Approximately 500 men will be employed in the yard, which, according to announcement, will be a permanent establishment. The Piaggio company has contracts for more than 30 ships.

* * *

F. F. Bingham, Pensacola, Fla., announces that he will build six 1000-ton auxiliary schooners immediately. Each schooner is to have an oil engine of 250 horsepower, and must make 10 knots.

* * *

Twenty-three men have entered the merchant marine engineering branch just opened by Tulane university, at New Orleans. James M. Robert, assistant professor of the department of mechanical engineering, is in charge of the new school, which was authorized by the navy department. It is intended to provide chief and assistant engineers, and is one of five schools in the United States so authorized. The course is to be of two months. The shipping board pays the tuition of the men who remain until they graduate.

* * *

Work has been begun by an authorized committee to raise $750,000 as New Orleans' share in the $2,500,000 corporation formed to restore Mississippi river traffic by the use of steel barges and tugs. The money will be obtained by sales of stock, the first subscription being for $25,000 by the New Orleans board of trade. It is planned to put 50 barges and 7 towboats on the river as the first fleet, to be increased as business demands. The line is to run between New Orleans and Minneapolis, calling at all way ports on the river. Practically every commercial organization in the Mississippi valley is interested in the new corporation.

* * *

The Alabama Drydock & Shipbuilding Co., Mobile, Ala., has closed a contract to build two 3500-ton full-rigged wooden ships, and four mine sweepers, according to an announcement by Dr. Harry T. Inge, one of the directors of the Alabama corporation. The contract comes from a Philadelphia firm, the name of which has not been made public.

* * *

More than $600,000 worth of shipbuilding is under way at Mobile, Ala. The Henderson Iron Works is building four submarine chasers; the oil tanker, SAN CRISTOBAL, is being rebuilt at a cost of $285,000 at the Ollinger-Bruce dry docks, and will not be ready before next spring; the seagoing oil barge B. L. WINCHELL, which has been building for more than a year, is nearly completed, and will cost $129,000, while four auxiliary schooners are well under way.

* * *

Unable to find cars to handle 25,000,000 feet of lumber to Cairo and St. Louis, the Great Southern Lumber Co. has appealed to the joint traffic bureau of the New Orleans Association of Commerce to provide water transportation for it. The appeal has been turned over to steamer and barge lines now on the river.

Boston Bay Notes

By George S. Hudson

STEAMER TIDEWATER, five months old, has been sold by Castner, Curran & Bullitt to Italian interests for $2,600,000. The ship cost about $600,000, the profit thus being about $2,000,000. The TIDEWATER has capacity for 8500 tons of coal with bunkers large enough for 6000 miles steaming. She will be placed in foreign trade for which she was designed although engaged since going in commission as a coal carrier between Chesapeake bay ports and New England.

* * *

The first trip of the new Boston fishing schooner ACUSHLA, Capt. Eben Parsons, stocked $5000, crew sharing $100 each. Better than that was a $7800 stock made by the mackerel seiner BESSIE DUGAN in 48 hours, this vessel's crew sharing $350.

* * *

A suit against the Coastwise Transportation Co. brought by the N. E. Coal & Coke Co., Boston, for alleged breach of contract has been settled. The case grew out of the withdrawal of steamer COASTWISE on account of a strike among officers and crew, the company claiming loss in operation if wages demanded should be granted as the long-time charter was at a very low rate, about 60 cents per ton between Chesapeake bay and Boston.

* * *

Capt. F. P. Whittier, South Berwick, Me., is in command of new 4-mast schooner NANCY HANKS built at Thomaston for Frank McQuesten, Boston, for $110,000 and sold before leaving the stocks to A. D. Carver, New York, for $125,000. Schooner has been chartered to carry general cargo to South Africa and voyage is expected to net $225,000.

* * *

Six-mast schooner WYOMING made the passage from an American port to France in 15 days in command of Captain Goodwin. Vessel was recently purchased from J. S. Winslow Co., Portland, Me., by France & Canada Steamship Co. to help replace tonnage destroyed by submarines.

* * *

Capt. Isiah Kelley, Harwich, Mass., died recently at age of 70. His last command was the Joy line steamer GEORGIA. For years, he was employed by Boston Tow Boat Co.

* * *

The Boston chamber of commerce has presented Boston light a 60-foot steel staff and flag. This light is the oldest beacon in the United States and is located on Little Brewster island 10 miles below the Boston wharves. The presentation was made by H. I. Harriman, president of the chamber, with a historical address by W. C. Brewer, marine underwriter.

* * *

The Ross Tow Boat Co. has sold tug SADIE ROSS, built in East Boston 13 years ago, to the government. The company has bought tug DOLPHIN from Lubec, Me., owners and it is announced that Capt. Smith Ross has been placed in command.

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Red Hot Tips From the Trade

Pertinent Suggestions and Personal Gossip

THE extensive line of direction and revolution indicators manufactured by the McNab Co., Bridgeport, Conn., are described in detail in a new catalog being distributed by the company. These indicators have been widely used on naval and merchant vessels throughout the world. They are being used on a number of vessels plying the war zones where skillful maneuvering is essential to safety. The catalog is profusely illustrated. Concise descriptions are given of the various types of indicators. Other steamship appliances also are described, including a pneumatic counter, boiler circulator and fuel economizer, whistle control and pneumatic engine counter.

New Detroit Office

The Duluth-Superior Dredging Co., Duluth, has opened an office in the Ford building, Detroit. Bamlet Kent, after 22 years of service in the United States engineer office at Detroit, has become district manager in charge of the new Detroit office of the dredging company. He has had an extensive experience in supervising dredging operations carried on by the government around the Great Lakes.

Die and Holder

The die and holder manufactured by the Greenfield Tap & Die Corp., Greenfield, Mass., are thoroughly described and illustrated in a catalog recently issued by that company. These dies were specially designed to give compactness with accuracy and strength. The catalog is liberally illustrated to show the various methods of using the die and holder.

Kraft Yard Enlarges

The Kraft Ship Yard & Dry Dock, Chicago, announces it has made a consolidation of interests and services with A. F. Mitchell & Son, electric boiler welding; the G. Brading boiler repair shop; the A. E. Clark electrical repair shop, and the E. G. Todt marine engine repair shop. This combination considerably enlarges the facilities of the Kraft shipyard, enabling it to take care of repair work on lake vessels of any character. The Kraft Ship Yard & Dry Dock is located at Ninety-fourth street and Calumet river, South Chicago. A complete organization for all kinds of above-waterline repair has been perfected. A circular signed by C. W. Kraft, A. F. Mitchell, G. Brading, A. E. Clark and E. G. Todt has been distributed announcing the consolidation of interests.

Engine Builder Expands

The Scranton Foundry & Engine Works, Inc., New York, has acquired the former plant of the Touhill Iron Works at Hickory and Mattes streets, Scranton, Pa. The company was recently incorporated with a nominal capitalization of $100,000 to build marine engines of from 500 to 2500 horsepower and to make gray iron castings. The plant includes four large buildings, several smaller structures, with a ground area of seven acres. Officers include M. J. O'Shaughnessy, president; Hiram Dixon, vice president; E. V. Davis, treasurer; Roger Brassell, secretary.

Buys Shipping Paper

The *Nautical Gazette,* an eastern shipping paper, has been purchased by the New York Evening Post Co. Oswald G. Villard is president, Emil M. Scholz vice president and treasurer, and Robert B. McClean is secretary. Walter B. Hayward, city editor and for years a writer for the *Evening Post,* is the supervising editor of the *Nautical Gazette.* James Gray, who for the past year has been editor and one of the owners of the *Gazette,* remains with the paper as associate editor.

John P. Kirk, Noank, Conn., recently was appointed inspector of hull construction in the New England district for the United States Shipping Board Emergency Fleet Corp.

Benjamin H. Elliott, formerly connected with the Barge Building & Repair Co., Brooklyn, N. Y., has accepted a position with the Universal Shipbuilding Co., Houston, Tex., as master builder. The Universal company has been awarded a government contract to construct twelve 3000-ton wooden ships.

Lloyd's *Register of American Yachts* for 1917 has just been issued. The book contains 520 pages and 48 colored plates. The number of yachts entered is 3590; clubs, 546; associations, 38; club and association burgees, 600; private signals of yachtsmen, 1872. The calling into government service of a large number of yachts complicated the work of compiling the register, but it will be found to be complete for the entire country.

Mechanical Refrigeration

The Clothel Co., New York, describes its system of mechanical refrigeration in a recently issued booklet. The chemical used in this system is ethyl chloride. This, it is said, is used to advantage at a low pressure. The size of the machine has been reduced and its operation simplified. The system has been employed on a number of yachts, naval vessels and merchant ships. The booklet contains a number of illustrations showing the installations employed on various well known yachts and destroyers.

Late Marine Patents

Copies of any one of these patents can be obtained by sending 15 cents in stamps to Siggers & Siggers, patent lawyers, National Union building, Washington, D. C., by mentioning *The Marine Review:*

1,223,416—Ship brake. Thomas O'Sullivan, Montreal, Que., Can.

1,223,536—Torpedo shield for vessels. John O. Travelstead, Pendleton, Ore.

1,223,616—Boat and its propeller. Otto A. W. Riecks, Everett, Mass.

1,223,627—Ship protecting shield. William A. Shephard, Waukesha, Wis.

1,223,730 — Diving boat. Lincoln Pierce, Tucson, Ariz.

1,223,747 — Submarine vessel. Abraham Johannes Van Stockum, Rijswijk, Netherlands.

1,224,027 — Submarine. Frederick W. Schoenen, Great Falls, Mont.

1,224,120 — Propulsion mechanism. Horace M. Cake, Philadelphia.

1,224,274—Vessel propelling mechanism. John A. Cashel, Worthington, Minn.

1,224,678—Marine vessel. Ernest L. Sons, Pittsburgh, assignor of one-half to Samuel A. Boyd and one-fourth to William L. McCandless, Pittsburgh.

1,224,679—Life saving device. Ernest L. Sons, Pittsburgh, assignor of one-half to William L. McCandless and one-fourth to Samuel A. Boyd, Pittsburgh.

1,221,012—Vessel mooring and positioning apparatus. James A. Anderson, New York.

1,221,282—Life boat for submarines. William Brown, Newark, N. J.

1,221,496—Leak obturating device for ships. Frederic Wullyamoz and Gustave Meyer, Lausanne, Switzerland.

1,221,087—Construction of turbine and like rotors. Charles Algernon Parsons and Alfred Quintin Carnegie, Newcastle-upon-Tyne, and Stanley Smith Cook, Wallsend, England; said Carnegie and Cook assignors to said Parsons.

1,225,252 — Motor attachment for boats. William James Johnston. Port Carling, Ont., Can., assignor of one-half to John Robinson Clair Hodgson, Gregory Ont., Can.

1,225,295—Internal combustion engine. John F. Wentworth, Quincy, Mass.

1,225,310—Internal combustion engine. John

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W. Burkett, Columbus, O., assignor to the Burkett Mfg. Co., Columbus, O.

1,225,498—Torpedo guard for war ships. Nikolaj F. Rodiziekevitch, Farrell, Pa.

1,225,662—Submersible vessel. Albert John Frederick Lee, West Ealing, England.

1,225,702 — Internal combustion engine. George E. Davol, San Francisco, Cal.

1,225,703—Fuel valve for internal combustion engine. George E. Davol, San Francisco, Cal.

1,225,796—Automatic fog safety ship's guide. Otto Fricke, New York.

1,225,824 — Rowlock. Henry W. Kippes, Brooklyn, N. Y.

1,225,913—Rudder control. Frank W. Wood, Montclair, N. J., assignor to Charles Cory & Son, Inc., New York.

1,225,992—Turbo-generator for ships. Robert V. Morse, Ithaca, N. Y.

1,226,014—Propulsion mechanism. George W. Rundle, Columbus, O.

1,226,055—Life-saving device for ocean vessels. Frank Bohn, Chester, Pa.

1,226,095—Row boat. George G. McDonald, St. Esprit, N. S.

1,226,098—Safe for seagoing vessels. Thomas McWatters, Chestnut Ridge, Pa.

1,226,141—Navigation protractor. Frank W. Sterling and Ralph A. Koch, U. S. navy.

1,226,274—Life raft. George F. Sweeney, Boston; Margaret Sweeney, Boston, administratrix of said George F. Sweeney, deceased.

1,226,348—Submarine mine and propeller entanglement. Arthur N. McGray, New York.

1,226,699—Boat. Frederick L. Saunders, Green Bay, Wis.

1,226,878—Means for securing ships' hatching coverings. Joseph Lunt Gordon, Liverpool, Eng.

1,226,881—Device for covering holes in vessels. Thomas R. Hatton, Appleton, Wis.

1,226,944—Life boat and the like. Harry W. Broady, Bayside, N. Y., assignor to Welin Marine Equipment Co.

1,227,093—Safety appliance for ships. Aloysius S. Terhaar, San Diego, Cal.

1,227,247—Collapsible boat. William H. Cox, Portsmouth, Va., assignor of one-half to Charles C. Brick, Salem, O.

1,227,284—Life saving boat. Thomas McWaters, Chestnut Ridge, Pa.

1,227,357—Propeller chamber or tunnel for shallow draft vessels. Harold E. Yarrow, Glasgow, Scotland.

1,227,784—High speed motor craft. Peter Cooper Hewitt, Passaic, N. J.

1,228,048 — Piston for internal combustion engines. George R. Rich, Oak Park, Ill.

1,228,049—Piston and internal-combustion engines. George R. Rich, Oak Park, Ill.

1,228,072—Rotary internal combustion engine. John M. Siner, Parish, Fla.

1,227,688—Starting device for internal combustion engines. Arthur L. Strahle, Benson, and Hiland B. Notes, Omaha, Nebr.

1,228,094—Motor attachment for boats. Britton E. Byrd, Durham, N. C.

1228401—Rotary explosive engine. Albert W. Bruce, Bloomfield, Iowa.

1228437—Tube cleaner for marine boilers. Jinkichi Hikida, Toyama-Ken, Japan.

1228628—Spark plug for gas engines. Charles R. Winston, Richmond, Va.

1228677—Ventilator cowl for ships. John Jenkins, Dalmuir, Scotland.

1228787—Propeller. Franciszek Kowalski, Philadelphia.

1228806—Internal combustion engine. Louis S. Morris, Bridgeport, Conn.

1228922—Wooden boat. Edward S. Hough, Oakland, Cal.

1229123—Life raft. Loring Willis Myers, Lubec, Me.

1229340—Internal combustion engine. John W. Smith, Philadelphia.

1229350—Spiral propeller for ships. John J. Tobin, Sayre, and Frank J. Gallagher, Wilkes-Barre, Pa.

1229583—Means for propulsion. Horace M. Cake, Washington.

1229713—Mechanical air-borne ship. George Albert Chaddock, Broad Green, Liverpool, England.

1229729—Vessel propelling device. Calvin H. Edinger, Fairview, W. Va.

Equipment Used Afloat and Ashore

Pneumatic Hammer for Calking, Beading and Chipping

A NEW type of pneumatic hammer especially adapted for all classes of calking and beading and for chipping all kinds of castings, steel billets, boiler plates and structural iron, has been developed by the Dayton Pneumatic Tool Co., Dayton, O. This company has recently moved into a new, specially equipped plant which is said to be the only plant devoted exclusively to manufacturing pneumatic hammers.

This hammer has long bearing surfaces which are said to increase the life of the tool almost one-half. The hammer contains only 12 parts, all simply designed. The company's hammers have been in service for some time. The hammer illustrated is adapted for medium chipping, calking and beading. It weighs 12½ pounds and is 13⅜ inches long. Five other types are built to handle lighter or heavier work.

Colored Gage Glasses for Marine Boilers

By Theodore Osborne

It is desirable for a boiler attendant to be able to see at a glance the exact level of the water in a boiler. It frequently happens, however, that owing to defective lighting and other unsatisfactory conditions occurring in a stokehold a close inspection of the glass is necessary in order to ascertain the water level. This is especially true when protectors are used, or when the gage glass is at a considerable height above the floor level, as is the case with water tube boilers. Under such circumstances, the attendant may mistake an empty glass for a full one and disastrous results may follow. A simple device has been developed recently for removing this difficulty. The apparatus is designed to color the water in the gage glass red, and by that means to enable the level to be readily seen from any angle and from a considerable distance. The coloring device consists of a small gun metal reservoir, which can be screwed into the top fitting of any water gage in place of the usual plug. When it has been placed in position, the reservoir is filled with water to which coloring matter is added and the reservoir is then closed by a screwed plug in its upper end. The colored liquid slowly drops into the water in the gage glass and keeps it a bright ruby tint in spite of the slow diffusion of the coloring matter into the boiler. The feed is maintained by steam, which leaks past a small valve in the stem connecting the reservoir to the water gage fitting. To increase the rate of condensation the reservoir is provided with copper fins, which are coated with a form of carbon. The coloring matter is stated to be entirely innocuous and there is no chance of staining the gage glass. It is also claimed for the coloring matter that the great temperature to which it is subjected does not destroy the color distinction. Nor do the salts often found in solution in boiler water affect it. The apparatus, in addition to being simple in action, is entirely automatic and requires no attention, except that it has to be refilled from time to time. Having been once replenished it will continue in action for about four weeks. The gage glass can be blown down as usual and no coloring matter from the reservoir is lost in the operation. It is stated that the idea of coloring the water in the gage glass in a distinctive manner originated in Germany. Since war was declared by Great Britain, it has been appropriated by British makers.

HAMMER ADAPTED FOR CHIPPING, CALKING AND BEADING

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